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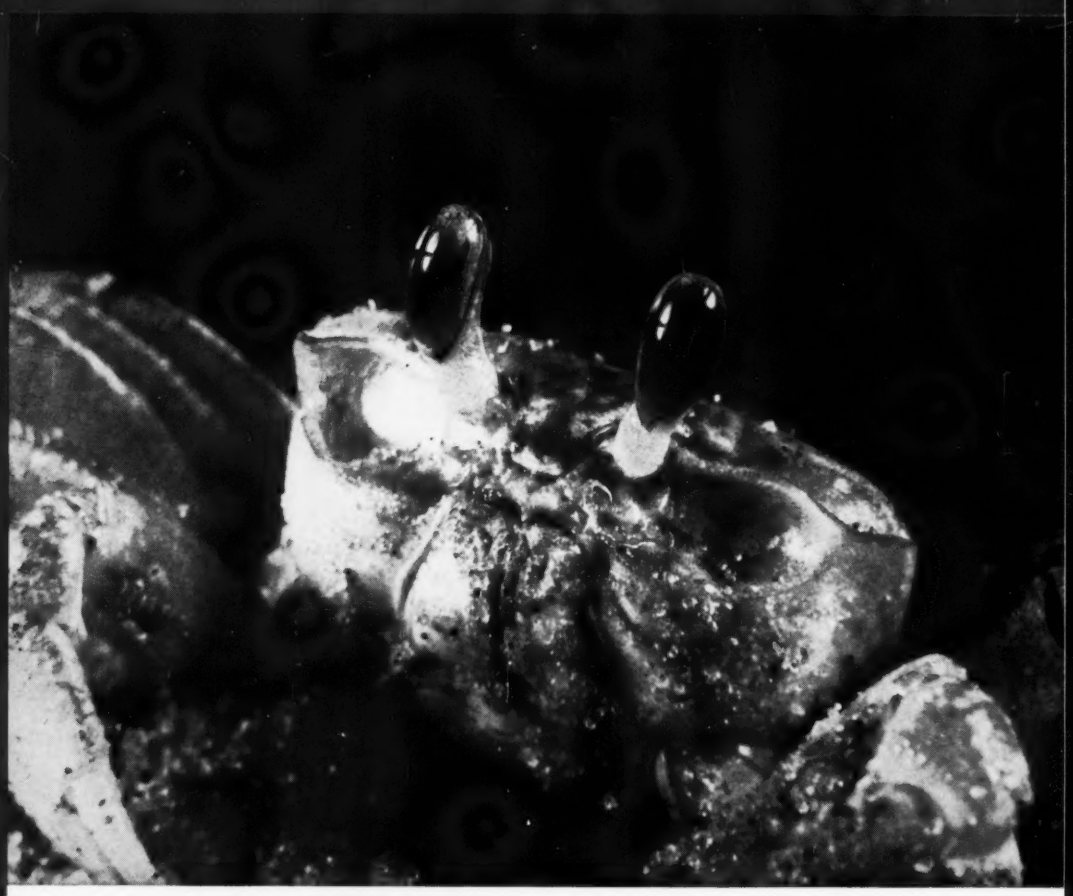

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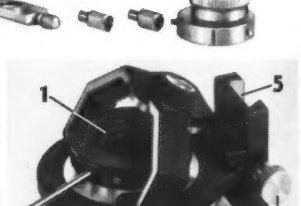

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COVER. The Ghost Crab, *Ocypode albicans*. Photo by William H. Amos, Noxontown Road, Middletown, Delaware.

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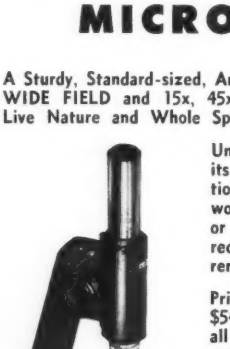

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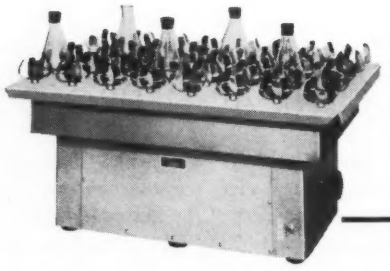

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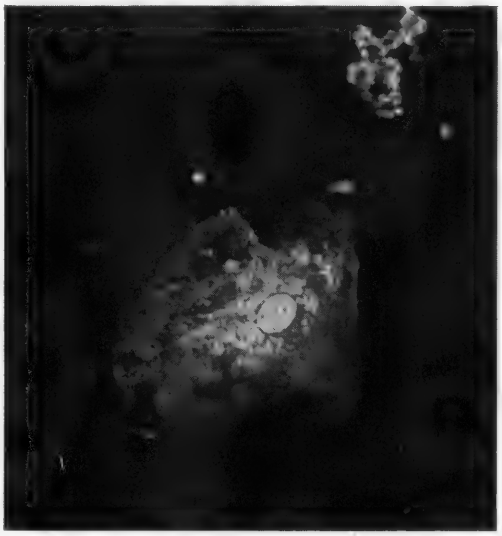

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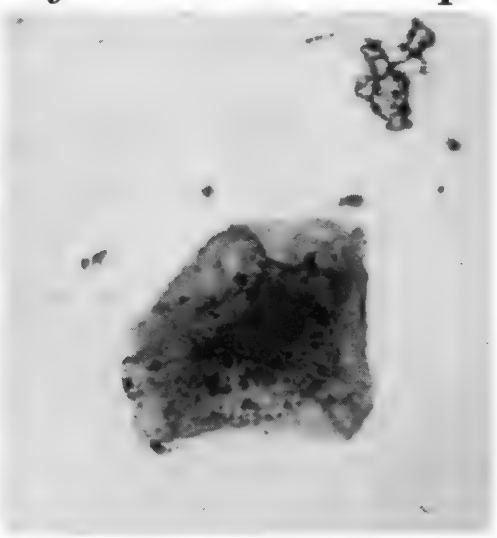

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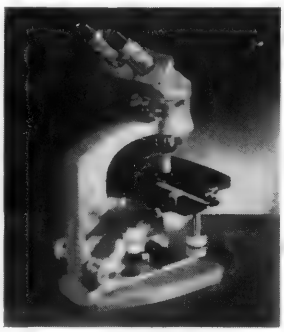

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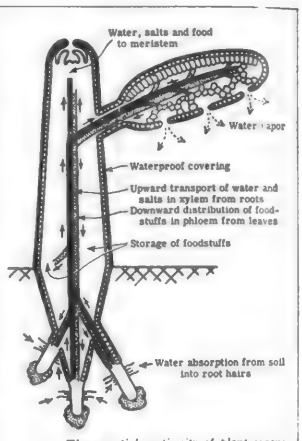
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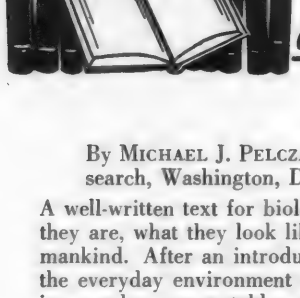

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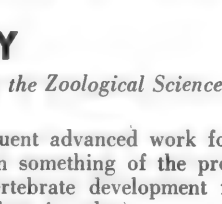

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The Challenge of Space Biology

IN a sense it is regrettable that the American Institute of Biological Sciences had to raise its voice recently in protest against the ruling of the Civil Service Commission which specifically excluded biological scientists from participation in a general salary increase provided for physicists and engineers. In general AIBS aims to campaign not for special favors for biologists but for better opportunities for biology to serve the present needs of man. The new space era will offer many such opportunities, some of which will be mentioned here; but every biologist knows that the real challenge to biology is to gain a better understanding of the nature of the life process itself. Biology is basic to both medicine and agriculture, and progress in both sciences is dependent upon advances in basic biological research. Support of this simple but little appreciated thesis is always the most vital objective of AIBS and its chief excuse for existence. Meanwhile, however, biology must be ready to respond to more immediate and practical demands including those connected with the satellite program.

To investigate these immediate problems the AIBS has been planning to hold a symposium on space biology at Bloomington, Indiana, as stated by Dr. Cox in his editorial of January 1958. Meanwhile, however, AIBS has accepted an invitation from the National Academy of Sciences to co-sponsor a similar symposium to be held May 14-17 in Washington. We are very happy to cooperate in this venture with the Academy which has taken the lead in so much of the IGY program. After this event it will be clear whether it would be useful to hold still another similar symposium in August. Possibly this may still be desirable for the benefit of a much larger and generally different group of people. If such a symposium could bring the minds of biologists to focus on these new problems it would doubtless result in the formulation of many new and useful opportunities for service.

The immediate problem for biologists of course is to think of ways in which satellites in orbit could be used significantly for biological research. One such experiment has already been suggested by an AIBS-ONR committee. This would involve the measurement of the CO_2 output of a yeast culture which could be telemetered in terms of the electrical conductivity of a solution of barium hydrate in which the CO_2 would be trapped. Such an experiment would tell us at least as much as the Russians can learn from their little dog. Even this simple experiment with yeast is no mean achievement for a weightless environment.

Both the yeast and the dog experiments have their limitations however. In both cases life and survival possibilities should be predictable within certain limits of temperature, oxygen, and carbon dioxide pressures, nutrient supply, radiation intensity, etc. If these are adequately monitored and kept within acceptable limits any failure of growth or survival can only mean the presence of some unpredicted environmental factor. However unlikely this may appear to be, the demonstration that life is actually possible in a satellite for long periods of time would be very reassuring. For a biologist also it would provide a real thrill to be in continual communication, of a sort, with any living cell circumnavigating the earth above the atmosphere. The effects of radiation could be tested in this way if yeast could remain exposed in a non-growing state in the satellite for varying periods of time before the initiation of growth by the automatic influx of nutrients. While there are many variations of this plan which would be of interest, most of the results could probably be predicted from terrestrial experiments if physical measurements were available of the radiation intensity in the environment of the satellite.

Another point to explore is the possibility of the existence of variable spores or virus particles in space. While this is highly unlikely because of the intense ultraviolet light to which such cells would be exposed, direct proof of the complete sterility of space would still be useful. It would help to dispose of the old panspermia theory of Arrhenius which supposed that living spores could be widely disseminated throughout the universe by the pressure of light rays. Possibly spores could be found in space on their radiation wings even though they might not be any longer viable.

A related problem is the possibility of testing the surface of the moon for the presence of living cells. However, if the moon is once hit by a missile fired from the earth the interpretation of such data might be ambiguous. In any event, a primeval surface would offer more points of scientific interest than one more or less disturbed by previous human intervention.

Surely landings on the moon and indeed manned flights in space are far in the future but not too far for scientific interest. Among the many difficult biological problems involved is the effect of gravity. On the take-off fortunately the acceleration is within tolerable limits provided the occupant can orient the long axis of his body transverse to the line of thrust. The complete absence of gravity when the satellite is in orbit will pose a still more serious and in some respects perhaps a more amusing problem.

For the maintenance of man over long periods in a satellite the nitrogen of the inspired air will presumably be completely eliminated and pure oxygen at a pressure of perhaps 15-21% of an atmosphere will be substituted. This will minimize the pressure differential on the walls of the satellite and will provide an adequate oxygen tension for survival. The effect of removing all the nitrogen from the ambient atmosphere has not yet been adequately determined although some have claimed that it tends to inhibit oxidations to some extent. Some decrease in basal metabolic rate may also result from decreased tone of the anti-gravity muscles. The diet should be designed for minimum weight and possibly also for minimum indigestible residue. At best it will have to be a survival menu of spartan simplicity. A new diurnal rhythm will be imposed upon the occupants, with night occurring perhaps every hour or half hour as in the present orbiting satellites. It will be interesting to discover how long the 24-hour rhythm will persist under these conditions and indeed in which direction it may become modified. For interplanetary flights the problem is still different with perpetual daylight—or at least a bright sun in a black sky.

For the biologist the most fascinating and challenging of all problems is the possibility of making a sealed cabin into a "balanced aquarium" or an autotrophic unit dependent only upon the input of radiant energy from the sun. A man is approximately equivalent in rate of energy turnover to a 100 watt light and this is in turn about equal to the radiation falling on each square foot of surface exposed to the sun. If, therefore, this energy could be used with sufficient efficiency the problem is not theoretically insoluble.

For this purpose one must either complete the solution of the chemical mechanism of photosynthesis or invoke as usual the aid of plants. Neither of these methods seems impossible. Great progress has been made by chemists and plant physiologists in their study of photosynthesis and some day it is probable that a useful test tube process for the removal of oxygen from carbon dioxide or its equivalent of water might become realized. It would certainly be as revolutionary for human life as the attainment of a method for using fusion energy.

On the other hand much attention is also being paid to the possibility of using cultures of chlorella to augment the food supply of the world. If optimum conditions for growth could be supplied, calculations indicate that it is not impossible to make effective use of chlorella for this purpose. This, however, involves recovery of all waste products in the excreta including nitrogen, minerals and water and their addition to the chlorella culture in useful form. Such a system if successful would at least substantially supplement the oxygen supply and nutrient supply of the satellite occupants and it is a problem well worthy of the serious consideration of biologists.

By effective participation in these and other problems there are many ways in which biologists will be able to qualify as "first class citizens" in the age which is before us.

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The Undergraduate Student and Scientific Research at a Liberal Arts College

SHELDON G. COHEN, M.D.*

Department of Biology, Wilkes College, Wilkes-Barre, Pennsylvania

TWO recent communications have pointed out important and rewarding but often neglected approaches to the stimulation and encouragement of scientific endeavor. Still (1956) has called attention to the vast and untapped reservoir of potential for a creditable degree of investigation that might be carried on at a "grass roots" level. Bush (1957) has pointed out the rewarding nature of an association and collaboration among scientists who are primarily engaged in such different fields of endeavor as the clinical practice of medicine and research in the basic sciences. These factors have held our special interest at Wilkes College, a small undergraduate school devoted to the teaching of the liberal arts. Here the consideration and combined application of these principles has resulted in the successful establishment of a program in experimental biology that has aroused an interest in original investigation among our own faculty, students and the college administration. Since some of our methods of approach have attracted attention elsewhere and brought inquiry from other educators, it was felt that the recording of our experiences might be of interest to others who by reason of location or association might wish to explore similar situations.

The prominent position occupied by liberal arts colleges in contributing to the ranks of natural scientists has been emphasized in a recent survey (Knapp & Goodrich, 1951). It is also to be pointed out that the concept of undertaking scientific research at collegiate levels is not a unique experience. Rather, it is our purpose to emphasize the intrinsic value and practicality of such a program and to outline some of the more novel and unusual aspects and approaches to its institution and administration. There is no attempt at comparison of our very modest effort at original investigation with those programs carried out at university graduate schools and research centers whose capabilities are enhanced by extensive physical facilities, library resources and the technical equipment required for exacting analytical procedures and specialized techniques. It is simply that we feel quite strongly that any individual talent for scientific investigation should not be neglected because of lack of opportunity or distances involved or the impracticality of association with such centers. Rather, every effort should be made to encourage scientific curiosity, provide the stimulation for potential investigators and to develop and fully utilize all existing facilities wherever and whenever any such possibilities may exist.

The Establishment and Conduct of a Research Program—Personal Experiences

As a physician interested in the basic science of immunology and its clinical applications to the practice of allergy, an invitation to enter an undergraduate department of biology to explore possibilities for seeking out problems of mutual interest subsequently proved to be a most enjoyable and rewarding experience. It did not take long for all concerned to become aware of the lack of sharply defined boundaries delineating our narrow fields of specialization in the presence of a common denominator of scientific curiosity and desire to probe further into the broad realm of biological sciences. Diversity of backgrounds, training, viewpoints and special interests among collaborators often proved to be an advantage rather than a handicap in attempting to set up a teaching-research program requiring collective efforts and individual contributions from faculty and associate participants.

A recognized advantage inherent in any small school is the opportunity for close and frequent faculty-student contact. The additional roles of advisor and preceptor played by the instructor allows for close surveillance of each departmental student and an evaluation of his potentialities and capabilities for participating in intra-departmental investigative studies. The more capable and talented student who will be able to maintain his general study requirements while devoting the required extra hours without sacrifice to other demands of the curriculum is gradually introduced into that portion of the study consistent with his background and course completion. Reference readings, laboratory assignments and conferences are designed not only to increase his knowledge of the subject at hand, but also to encourage his interest and stimulate the development of a degree of responsibility required for eventually undertaking the study of a minor problem of his own under adequate supervision. This first step towards his development in the field of biological sciences has often been of unquestioned value in introducing the student to a consideration of undertaking advanced study preparatory for a career in this field. Yet we do not feel that the value of personal experience of participation in a research program should be limited to a few such select students. For those of lesser ability or for those who may be able to devote only a limited amount of time every effort is made to interest them in a group project. This on occasion has been responsible for calling to our attention some hitherto unnoticed talent and ability in a student possessing an otherwise mediocre record who may deserve the benefit of special attention in his particular scholastic problem. Often this group association in an introduction to research techniques and original thought has served to activate within the student a true realization of his interest in biological sciences.

It has been our purpose and plan to encourage rather than to assign participation in this program designed to introduce the student to an organized systematic approach to scientific research. Discussions relating to the development of the problem and formulation of an experimental protocol in student conferences are the initial step. This is followed in turn by assigned reference readings and periodic scheduled seminars for the charting of progress reports, analysis of data and outlining of future approaches. Where the student is treated as a collaborator rather than a laboratory technician there has been no problem in obtaining his cooperation, enthusiasm and the extracurricular time required for the completion of an experimental study. Our cause has been further facilitated and encouraged by the annual program of the Eastern Colleges Science Conference providing these students with invaluable experience and the medium for formal presentation of their reports.

A limited departmental budget that did not allow for the purchase of complicated and specialized items of equipment did not prove to be an insurmountable barrier when standard items of equipment found within the student laboratories of biology and chemistry were made available. By improvising wherever possible and calling upon the willing and often overlooked talents of members of the college and community population such as carpenters, electricians, plumbers and metal workers, these simple tools were surprisingly modified and adapted to our specialized needs.

Laboratory space is always a critical essential need in the average small college devoted exclusively to teaching. However, it has been our experience that administrative officials are usually totally sympathetic to such situations when properly appraised of the problem. As our requirements for space increased, college officials with the

* Associate Professor of Biological Research, Wilkes College; Chief, Allergy Service, Mercy Hospital; Committee on Education, American Academy of Allergy.

help of maintenance carpenters never failed to find some unused portion of a student laboratory or classroom building that could be remodeled and adapted for our purposes. Patient utilization of existing equipment and facilities, productive efforts and cooperation with administrative officials were appreciated and eventually rewarded by including provision for space designed exclusively for research laboratories in plans for new building construction.

Library facilities especially pertaining to technical bulletins, scientific textbooks and current periodicals in biologic and physical sciences are often inadequate at both the small liberal arts college and in the small community of its location. Although at times inconvenient, this problem did not prove insurmountable. The valuable assistance of the college librarians was enlisted in searching for and obtaining bibliographic materials and reference literature through local hospital libraries, governmental and university library loan and microfilming services and the sympathetic cooperation of other investigators in supplying reprints of their publications in related fields.

The employment of trained laboratory personnel and technicians is highly desirable but is also a luxury not often indulged by the average departmental budget. Much of the routine housekeeping chores were effectively handled by students eager to seek part-time employment on campus and the educational background of advanced students was compatible with their undertaking to learn technical laboratory procedures. We have found that with proper supervision and encouragement, students who are made to feel that they are actually collaborating in a research study and will work for the value of gaining experience with or without minimum compensation are generally more valuable than the average technician working primarily for salary.

It is not intended to imply that all this can be accomplished without funds. To provide for the purchase of certain items of equipment not immediately available in student laboratory stockrooms and the compensation of some student help the college administrators must be willing to take the initiative and increase the departmental budget. However, this will not prove to be an undue or prolonged strain for there are usually farsighted people and organizations within every community who can be interested in initially contributing to the function of such an educational program. Eventually, when one has been able to demonstrate ability to conduct this type of program and to prove the willingness of the college to offer complete cooperation, the question of research grants can be translated from a possibility into a probability through the encouragement and sympathetic understanding of philanthropic organizations, research foundations, industrial corporations and governmental agencies.

Role of the Undergraduate Student

The place of scientific research in education has always properly belonged at the graduate school level, the recognized training ground of the future investigator. The very modest program that may be the only type possible at the small liberal arts college is in no way intended to even partially overlap this but rather to serve as an introduction and stepping stone for the student into an exploration of further opportunities. We have found this medium especially advantageous to the participating student in providing: (1) the stimulus for the development of original thought, (2) an introduction into research methods and experimental techniques, (3) specialized instruction, and (4) future applications of special interests.

Too often students master the technique of study sufficient for passing examinations with a creditable academic record and yet have had no opportunity for original thinking. To attempt an application of formally presented classroom material to an organized search for that which is yet to be learned is usually a stimulating and awakening experience. It is the function of a liberal arts college not only to teach, but to prepare for advanced training and adjustment to the future. The seed for independent thought and inquiry can never be sown too early in an academic career.

It is important for the student to learn the ever-changing concepts of scientific theory and to realize that which may be an accepted textbook fact one day may have to be modified the next day as a result of further methodical advanced study into the problem. His true understanding of the investigator can be appreciated only after an introduction to the reference library, background study, planning of preliminary experimentation and the satisfying nature of time spent in these pursuits. The training value of a methodical and systematic approach to problems, the organization and interpretation of newly acquired data and the necessity of controlled studies are obvious. The latter undergraduate school years are not too early to present this experience to the student if it is our function to evaluate individual adaptability for graduate study and to provide the encouragement and stimulation for entering upon the advanced training required for an investigative career. In the case of the preprofessional school student destined for long hours of pure didactic teaching, hospital internship and care of patients this background has been especially valuable in helping him to appreciate the vast importance of the fundamental biologic research that has given men access to the knowledge required in the clinical practice of the medical sciences.

It is to be pointed out that the specific problem or subject matter under study is consequently of secondary importance to the student and yet in certain instances may be of unusual value from the point of view of instruction. Limited facilities and available faculty members in turn necessarily limit the departmental curriculum offered to meet the minimum requirements for a broad general understanding of this field. However, when a student with unusual ability or interest can be singled out from among the classroom group an evaluation of his talents may often indicate justification for special instruction and guidance. By allowing him to participate in intradepartmental research an opportunity is presented for added instruction through means of the reference readings, library search, laboratory procedures and informal conferences required of the participating student in his close contact with the faculty member. This approach to an introduction to some field of biologic specialization has often been justified in awakening sufficient interest in the student to consider the pursuit of graduate study in this or a closely related field. Also, by utilizing this informal technique of instruction, we have been able to emphasize to the undergraduate student the important place of basic science in related applications to industrial and clinical fields. This has been of especial value in the case of the pre-professional school student with a premature fixation on the medical sciences to help him appreciate the fact that a knowledge of cellular biology even at the plant and protozoan stage is essential to an understanding of basic facts in physiology and biochemistry that may apply to the human organism in health and disease.

The exposure of an inquiring mind to a personal experience in a new and intriguing subject may often lead to a desire for applying this newly acquired interest to future opportunities. In this regard the basic field of immunology and its application to the clinical practice of allergy is cited as an example only because of the author's personal experience. There is sufficient evidence to justify that these same factors can be successfully applied to other biologic, physical and behavioral sciences. The Committee on Education of the American Academy of Allergy in encouraging the development of educational programs in medical schools and postgraduate training facilities has recognized the vast potential for stimulating initial interest in specialized scientific fields at even lower levels of the educational ladder. Through the introduction of some undergraduate students to fundamentals and basic concepts in immunology we have seen two very important contributions. First, the kindled interest of some of these students to enter upon graduate training in microbiology and biochemistry and eventually the field of immunochemistry where the critical need for trained investigators is vital for the fundamental research necessary for the continuing resolution of the complexity of problems underlying the allergic individual. Secondly, that the stimulation of interest in basic immunologic phenomena is often carried by the student into his medical school years and in turn may lead to a better understanding of the applications of these principles in the teachings of hypersensitivity reactions. In this regard we have found that the lesson served by an assistantship in the research laboratory has been especially impressive and need not be neglected because of inability or impracticality

of formal instruction or extensive lecture presentation on the subject.

Role of the Faculty

The importance of faculty participation in scientific research is self-evident. This poses no problem at the university endowed with sufficient funds allowing for an adequate research budget and a supply of graduate students eager to assist and participate in this departmental function. However, the situation of the faculty member in the small liberal arts college has not been fully appreciated in this regard. Not only is he hampered by a lack of research funds, physical facilities and technical assistance, but the full work load he is required to carry in association with formal instruction and administrative functions is sufficiently overburdening to discourage talent, interest and ambition. It is therefore gratifying to realize that some type of investigative program, although limited, is nevertheless feasible and that under certain circumstances the talents of undergraduate students can be utilized to good advantage.

It is in further consideration of preventing such hampered interest and thwarted desire to carry on original investigation that the position of the part-time research associate can be appreciated. The value of inviting men of scientific training and interest residing within the community into a departmental association for the purpose of assisting in the conduct of a research program cannot be overemphasized. With the further understanding of the complex relationships of biologic functions and the demonstration of interdependence of life processes within an organism and often within the same cell, the sharp lines of division between arbitrarily created fields of specialization are rapidly fading. More than ever is the function of the research team in original investigation appreciated by those engaged in scientific endeavor. Within a community there are men of scientific training and interest, such as physicians, veterinarians, industrial chemists and engineers, who might welcome the existence of an opportunity to contribute their talents and a limited amount of time for the purpose of collaboration in scientific endeavor and investigation. The biologist engaged in education may find it a thoroughly stimulating and gratifying experience to associate himself with one of these clinical or industrial scientists in exploring problems of mutual interest. Thus, not only is the individual burden of the work load lightened, but also the lines of research resulting from their combined talents, thoughts and contributions may take a more fruitful direction.

Summary

In summarizing personal experiences, we have become convinced that the only prerequisites for the establishment and satisfactory conduct of a research program within a science department of a small undergraduate liberal arts college are those concerned with: the interests and desires of the faculty members to carry on original investigation; their ability to stimulate students to participate in scientific research without regard to the particular subject matter of study and the willingness and farsightedness of college administrative officials to encourage the development of such research programs. The introduction of the undergraduate students to research techniques has been of unquestioned value in providing him with the opportunity for the development of original thought and the stimulus and encouragement to seek advanced training in graduate departments of the biological sciences. In the initiation of this program there are many obstacles to be overcome including the need for and source of research funds, physical facilities and technical assistance. However, our experience has demonstrated that these are not insurmountable and can be rapidly resolved if the desire to conduct scientific research does exist among faculty, students and the college administrators, with their willingness to cooperate in this endeavor. The invitation of man of scientific background residing within the community into part-time departmental collaboration can result in fundamental contributions to the research program. It is important to realize that at the onset one should be satisfied with a very modest program and the utilization of existing facilities. In turn, within a short time when results are evident one's efforts will be appreciated and further approaches to the problem facilitated with continued growth of the initial project through administration and community acceptance.

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Undergraduate Training in Experimental Research

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UNIVERSITY courses in biology tend to follow a set pattern, and many of the elementary courses offer little challenge to the thinking student. All too often instructors give the beginning classes a worn-out story that does not represent current thinking, except perhaps in the instructor's own specialty. Only when students become juniors or seniors (if they are still with us), do they learn the true workings of biology as a science. Peters (AIBS Bull., 7 (3): 14-16. June, 1957) has described the apparent success of a new approach to instruction in biology at Brown University. A more drastically modified approach has been suggested by Knepton (Turtox News 35:72-73. Feb., 1957). Both plans presumably would provide a greater challenge to the student, a closer relationship between students and faculty, and a greater impetus toward research. At the University of Utah we have organized a course, to be taken by students early in their college careers, that we believe achieves the same purposes.

Experimental Biology 10 (abbreviated EB 10) was proposed to introduce undergraduate students to experimental research in biology. At its inception the course was designed to provide physicists, chemists, and mathematicians with a greater appreciation of experimentation in biology. The course has now been offered during six quarters over a three-year period.

The University Catalog describes EB 10 as:

> Elementary Experimental Biology (5 credits). An elementary course illustrating the application of the experimental (physical-chemical-mathematical) approach to biological problems. Especially suggested for engineers and for chemistry, physics, and mathematics majors. Five lecture-laboratory periods per week. Prerequisite: Consent of the instructor.

It is one of several courses accepted in partial fulfillment of the University's General Education requirements in Biological Sciences. Most of the students who register are sophomores, a few are in the third quarter of the freshman year, and a few others are juniors or seniors. They have some background in physical science, but most have not yet reached the advanced courses in physics and chemistry.

Experimental Biology 10 might never haxe originated except for the administrative arrangement of the Division of Biological Sciences at the University of Utah. These are four separate departments: Botany, Zoology, Genetics, and Experimental Biology. The latter department is concerned with general and cellular physiology, although it has no formal connection with the Physiology Department of the Medical School. Since each of the sister departments has a beginning course, it was important, for highly practical reasons, that Experimental Biology should also offer such a course relating to the subject matter of the department. However, General Physiology is more profitably taught to students with advanced standing.

The idea for EB 10 was originally suggested by the Head of the Department, Dr. John D. Spikes. I have been in charge of the instruction since the course was first offered. At first it was frightening. How does one demonstrate the experimental approach to sophomores who know only a little biology, and have just started chemistry, physics, and mathematics? I must admit that those seven brave students (two from engineering, two from physics, one from chemistry, one pre-med, and a music major) who registered in January, 1956, helped me a great deal.

Since that first quarter, the class has grown, and the course has been much improved. EB 10 is now offered each quarter instead of but two quarters as originally planned. We have space for only about twenty students at one time. We now have many more applicants than we can accommodate, so we are able to restrict the enrollment to those majoring in science or engineering. Each class is thus a select group of students who already show promise in science.

It is now possible, in retrospect, to formulate and formalize objectives. The following list will give an indication of what we hope to accomplish:

1. To explain the theory, rationale, or philosophy behind experimental research.
2. To demonstrate techniques, instruments, sources of information, and other tools used in various types of experimentation.
3. To permit students to observe scientists at work and to learn that biology can be exciting.
4. To point out some of the difficulties inherent in experiments using living material.
5. To provide an opportunity for students to express themselves, orally and in writing, leading to improved communication.
6. To attract students into biology from the more "glamorous" physics and chemistry.

EB 10 is still an experimental course. It has never been taught exactly the same way twice. More features have been added than removed. Even though the course changes every quarter, there is still a general pattern. Usually the first few are spent becoming acquainted with laboratory facilities, with the University Library, and with each other. Each student writes a brief autobiography, including notes on reading habits and personal philosophy.[1] We also discuss briefly the various sources of information relating to the field: books and monographs, journals, abstracts, handbooks, and the like. Some time is spent on the scientific approach to problems, from both practical and philosophical viewpoints. The length of time spent in these discussions depends upon the class. Whenever they seem to have their ideas well organized, we turn to something else. From this point, the presentation of experimentation in biology follows a more-or-less classical scientific method: selection of a problem, quantitative observations, treatment of the data, and finally, formulation of interpretations.

These young people have no idea how we, as biologists, decide what we wish to investigate. After a lecture or two, illustrated by some carefully selected papers from the current literature, they begin to realize that there is no shortage of problems. Freshmen and sophomores respond to journal articles just as we do. "Why didn't they do it this way?" "If we set up such-and-such equipment, we could get an answer that these authors missed." "They wrapped up one problem, but look how many others they opened up."

This phase is followed by discussions of experimental design and demonstrations of most of the common techniques used in quantitative experimentation. Typically the students see and participate in gas exchange measurements, chromatography, isotopic tracer techniques, spectrophotometry, preparation of tissue samples and sub-cellular particulates, centrifugation, and potentiometric techniques. Frequently about half the class is asked to find as much information as they can about any one of these techniques, even before they see the method demonstrated. When they return from the library, they elect a chairman to organize their discussion, and each member gives an informal report. With no help from their instructor, they usually present the history of the development of the method, the physical or chemical principles involved, the common sources of error, and some specific applications of the technique. The following day we demonstrate the equipment in operation. A few days later, the other half of the class presents a similar discussion of another of the methods. This phase requires a great deal of time, but it can be justified as a demonstration of the versatility demanded of the experimental biologist.

After the class is familiar with the types of results that might be obtained in an investigation, we discuss methods of treating data, e.g., selection of dimensions, calculation of relationships between sets of numbers, and preparation of tables and graphs. We also introduce them to the most commonly used statistical treatments, and, for want of a better place in the sequence, the statistical design of experiments.

As a last step, we talk briefly about the interpretation of data and the relationship between the measured results and the original statement of the problem.

After this preparation, the students are allowed to select a problem and conduct a bit of research on their own. Usually a list of projects is prepared—projects that can be finished in the short time available—although any student who suggests a reasonable problem is encouraged to follow his own curiosity. Many of the proposals offered by the instructor can be related to his own research program, because there he can be of most help. Unfortunately it is usually necessary for the class to work in groups of two, three, or four, rather than individually. The students seem to realize the value of individual work, however, and it is seldom that any member of a team "goes along for the ride."

The Experimental Biology Laboratory is an exciting place while these enthusiastic "researchers" are working. Naturally biological experiments cannot be performed entirely within the schedule class time, and the class devotes many extra hours to the problems. Last year one small group made manometric measurements from seven to about eleven every evening for a week! At the close of the Spring Quarter, 1957, one student had satisfied the course requirements, but he had not satisfied himself. During the summer he worked at a full-time job from 4 p.m. until midnight, and spent his days in our lab. He will be one of the co-authors on a forthcoming publication.

When the experimental work is completed, a paper is prepared as if it were to be submitted for publication. Each student selects a journal appropriate to his problem and follows the style sheet of that particular journal. Each has a list of references, for they have learned that politeness,

[1] This helps to summarize the students' backgrounds and gives some idea of their capabilities. It also provides some information about their ability to write in English. Those who write poorly are given more practice.

if nothing else,[2] demands the acknowledgment of previous work. Our only short-cut at this stage is in the preparation of illustrative material, because we do not have time to ink in curves or prepare photographs. Assistance is given at this stage by oral examinations on their research and criticism of first drafts.

The last two meetings of the class are devoted to the Quarterly Meetings of the Utah Sophomore Society for Experimental Biology. Each group appoints a speaker to present their paper to the rest of the class. An opaque projector is provided as a substitute for the customary slides. The reports are recorded on tape; and, subsequently, the speaker and the instructor criticize the performance and make suggestions.

To illustrate the kinds of problems on which the students work, a few examples might be given. One group constructed a chamber, coupled to the magnetic oxygen analyzer, in which they could measure the oxygen absorption of a laboratory mouse subjected to controlled frequencies of sound. They found that respiration was stimulated by a well-defined range of frequencies. Frings and Frings (Jour. Acout. Soc. Am. 24:163. 1952) reported that these same frequencies, at higher intensities, induced audiogenic seizures in mice. Another group developed an improved method for spectrophotometric analysis of chlorophyll mixtures. Only a lack of the time required to verify constants prevented the preparation of this work for actual publication. One student, working alone, used a difference spectrum to identify a cyanide-cytochrome c complex, even though cytochrome c is known to react only slowly with cyanide. This has not been confirmed, and we suspect an impurity in the sample of cytochrome c. Several of the reports received so far have been potentially worthwhile contributions. The papers commonly contain a comment in words to this effect: "We regret the tentative nature of these conclusions, but time did not allow the proper replication and extension of the experiments."

Source Material

So far there is no text that even approximately parallels the course material. Probably the use of a text would make the course easier for many students, but it would defeat some of the purposes. We do obtain help from a number of sources, however. In our discussions of science and the scientific approach, we use the little monograph by Lachman, *The Foundations of Science*, as a starting point. It is written in a simple, straightforward style, and even freshmen have no trouble with it. Later, we have occasion to refer to Bernard's *Introduction to the Study of Experimental Medicine*, Wilson's *Introduction to Scientific Research*, Conant's *Modern Science and Modern Man*, and the Gabriel and Fogel collection of *Great Experiments in Biology*. Much of the suggested reading comprises carefully selected papers from the current literature. Changing these papers each quarter helps to maintain the enthusiasm of the instructor! The minimum amount of recommended reading depends upon the needs of each class. The amount of extra reading done by each student is an individual matter. Most of the reading materials are readily available in the Department Library as well as in the University Library.

Equipment

Throughout their work, the class members observe and handle research-grade equipment exclusively. We feel that a special set of low-quality, poorly-functioning, student-grade equipment teaches little and represents a waste of the students' time as well as our own. It may be surprising to some, but the mortality rate has been very low. Apparently the students have enough awe of expensive equipment and are so flattered at being trusted with it that they handle it very carefully. They even break very little glassware. Our most serious accident to date occurred when a young man, intended to inject a mouse subcutaneously, pierced the whole fold of skin and injected 0.1 ml. of isotonic saline into his own finger.

Comments and Recommendations

Our sophomore students are extremely eager and surprisingly competent. I am convinced, after working with six such groups, that they are more capable than we commonly realize. Upon this point I am in complete agreement with Peters, whose students at Brown University have demonstrated their abilities. The members of every class so far have proved that they can work scientifically at this age and level of training.

In some of our discussions the ideas flow very rapidly. Sometimes the group is difficult to control because everyone wants the floor. With a minimum of direction these discussions usually lead to the same general conclusions that scientists and philosophers of science have reached. The chief problem that arises in these sessions is that much of the time the class is afraid to disagree with the instructor. Thus, care must be taken to promote the development of a skeptical attitude.

Occasionally one of the students is incapable of progressing with the class. The less capable students are likely to be completely bewildered when they are asked to initiate their own research problem. In spite of my efforts, I have found no very effective way to help these people.

Frequently even the student who is lost will contribute a bright moment to the lighter side of teaching. One participant brought in the first draft of his paper with the incongruous title, "The Optical Density of Sugar Beets Compared with that of Other Known Concentrations." Another, impressed by English instructor's suggestion that he learn some new words, turned in a paragraph told the following story (slightly condensed):

> A mouse had an antipathy to his cage until exposed to the idiosyncracy of the experimental conditions. If he had remained in an inane state of shock and lapsed into a phlegmatic state, the experiment would have progressed more suavely. However, we must rationalize ourselves on the imbroglio of the subject.

But these are extreme examples. Many of the papers would need only postage to be sent to almost any editor. Except for the need for confirmatory statements, some of the papers were almost ready for publication.

The principal reason for this report is that our experience may be valuable to someone else. I have described the course to some of my friends, and the typical immediate response is "Impossible." Of course, EB 10 requires a great deal of time and patience from the instructor. Freshmen and sophomores who are using research-grade equipment demand close supervision. Groups of people rushing in and out every hour of the week might unhinge an impatient man. To one who loves teaching, however, the satisfaction of watching the liberation of a suppressed curiosity is indeed a triumph.

Anyone who contemplates a course of this sort must realize that a tremendous amount of work is involved, at least at the start. In each new situation, the subject matter, the teaching methods, and the reading material would have to be adapted to the situation and to the students. Our experience suggests that it is wise to keep the organization flexible at first, until a workable pattern can be devised. The University of Utah has no Honors Program at present, but schools where a special set of Honors courses is in operation might consider a course of this nature.

It is still too early to evaluate the effectiveness of this program. Much of what is offered to the students will not be retained, but this is true in any course. The drill in writing and speaking, the increased familiarity with the library and the literature, and the exposure to the physical methods of experimentation must be valuable, no matter what the students do in the future. This brief encounter certainly cannot make scientists of these students, but we believe that it gives them a greater appreciation of experimental research. It is difficult to estimate, as yet, the effectiveness in recruiting biologists. A few former EB 10 students have indicated that they intend to pursue biology as a career. Several are presently taking more biology courses as electives. At least two have expressed the desire to finish the major in chemistry as preparation for graduate work in experimental biology.

The members of the class are made welcome in our laboratories and are urged to spend as much time as they can spare observing the research activities of our staff. By the end of the quarter, they usually know most of the faculty, the graduate students, and the technicians, and have a reasonable knowledge of the various research projects.

[2] Somehow, the accusation of impoliteness is the most effective means of assuring proper citations to the literature. When conventional arguments were tried to convince them of the importance of references, they agreed completely, and then left the references out of their papers.

Opportunities for Land Vertebrate Research in New Zealand

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NEW ZEALAND offers a variety of animal habitats which extend for approximately thirteen degrees of latitude, over elevations rising to 12,000 feet, and whose rainfall varies from about twenty inches to over 300 inches a year.

This paper describes some of the major opportunities for study associated with the New Zealand environment and emphasizes the uniqueness and transitory nature of several research opportunities associated with land vertebrates introduced into New Zealand about fifty to seventy-five years ago.

In the writer's opinion the most important research opportunities in New Zealand arise from three special causes: (1) the introduction of a mammal fauna into a land originally without mammals, (2) the intrinsic nature of the indigenous fauna, and (3) the present early period in the growth of land vertebrate research.

In some areas it is a common sight to see burned trunks of trees of the original forest standing and surrounded by rapidly improving grassland. Several forest trees, for example totara (*Podocarpus totara*), and rimu (*Dacrydium cupressinum*) may live for over 800 to 900 years. Thus growth rings in trunks of trees still standing in New Zealand have been laid down before the main migrations of the Maori to New Zealand and nearly 500 years before the landing of the first European.

The first naturalist to visit New Zealand, Sir Joseph Banks, did so briefly in 1769, with Captain Cook. It was not until 1838, however, that the first professional scientist, a geologist, received an appointment with the New Zealand Company (Dick, 1957). The inaugural meeting of the New Zealand Institute, later to become the Royal Society of New Zealand, was held in Wellington in 1868, nearly 100 years after the visit of Captain Cook. Only within the past ten years has research on wild and feral vertebrates been provided for in the budgets of two government departments, the Department of Scientific and Industrial Research and the Internal Affairs Department; and, as recently as 1956, the New Zealand Forest Service included wildlife research work in their research program.

Table 1 summarizes the liberations and results of introductions of 214 species, largely between 1860 and 1914. Although the majority of attempted introductions failed for various reasons, at least 70 species (one-third of the introductions) became established. Some of the mammals, such as rabbits and deer, are animals that are economically important in their native lands. In New Zealand, as well as overseas, some animals, like the game-birds, are managed for sport; and some animals, like the big-game animals—under certain conditions—come in conflict with human interests and thus become known as problem animals (Riney, 1952).

TABLE 1

Summary of Vertebrates Introduced to New Zealand (after Thomson, 1922)

	Species Introduced	Species Established	Not Established
Mammals	48	27	21
Birds	127	31	96
Reptiles	3	3	
Amphibians..	5	3	2
Fish	31	8	23
All animals ..	214	72 (33%)	142 (67%)

For a country whose history of vertebrate research is still young, it is a simple matter to compile a list of desirable research projects. However, no attempt is made to present such a list in this paper, and the following examples are restricted to mammals and birds and show that several potential major lines of research are either unborn or in their infancy.

The history of the world of animals is not only one of the constant evolution of new species, but is also one of constant extinction of species that could not survive through the changing climates with their changing biomes. Associated with extinction we normally postulate an altered ecosystem with, theoretically, an elimination of at least one critical part of the ecologic niche of the species. Recent studies based on evidence from soils (Raeside, 1948), and forests (Holloway, 1954) indicate geologically rapid changes in climax vegetation in New Zealand. In some areas, superimposed upon these changing climates have been catastrophic eruptions by the great volcanoes. Marked vegetational changes can still be observed over large areas and traced back to these dated eruptions. Since settlement by Europeans, large scale and influential changes have occurred especially in lowland areas. New Zealand thus offers several opportunities for naturalists to come to grips with the process of extinction. At least one species of small moa was used by the early Maori within the last 200 years. It is probably extinct, but we can only say probably. The kakapo, the large ground parrot (*Strigops habroptilus*), has markedly decreased in numbers within the past century. Are the few kakapo remaining in the South Island also marked for extinction? The ranges of several birds—e.g., Takahe (*Notornis mantelli*), kokako (*Callaeas cinerea*), saddleback (*Philesturnus carunculatus*), stitchbird (*Notiomystis cineta*), and bush wren (*Xenicus longipes*), and of one reptile, the tuatara (*Sphenedon punctatum*), are restricted to but a fraction of their former size. Each of these species can be studied and should be intensively studied. The causes for the reduction of their numbers probably differs, but each of the species, for various reasons, provides a wonderful opportunity for understanding some aspect or other of the processes of extinction.

New Zealand has a higher proportion of flightless or near flightless birds in its avifauna than any other country in the world. This fact, and the fact that several of these flightless birds are found in a single area, the Fiordland area, make the study in this area of kiwis (*Apteryx sp.*), wekas (*Gallirallus sp.*), notornis and kakapo a unique opportunity. The kiwi, New Zealand's national bird, occurs in thousands in suitable habitat in both islands, and has yet to be studied. There has yet to be the first serious study made of the natural history of any of these flightless birds and at least two of them, the notornis and kakapo, are on the rare bird list. The notornis, relocated in 1948 by Dr. Orbell (Falla, 1948), has since been visited almost yearly, has been banded, and the population has been closely watched. Last year for the first time, an attempt was made to hatch a notornis egg under a bantam hen.

Closely allied to the study of the principles involved in the extinction of animals are studies of the reasons for the failure of many of the liberations in New Zealand (see Table 1). Some of the species noted as being most successfully adapted to the country are characterized also by the numbers of liberations that were unsuccessful, for example the red deer (*Cervus elaphus*). Such studies should throw new light on essential requirements for the existence of these species.

One major research opportunity still available to biologists in New Zealand is to study the process of colonisation. In New Zealand we can observe species indigenous to other parts of the world, in the process of dispersing into new environments, colonising some areas and passing others by, and can search for common elements between the New Zealand environments and those of their native land.

An interesting aspect of the study of competition between two species is the question of to what extent overlapping occurs in the specific essential requirements for existence between introduced birds and native birds on the same hillside. Are there examples of native birds being reduced in number because of competition with introduced birds? Problems of competition between wild and domestic animals at pres-

ent closely resemble those in the western United States, but the study situation in New Zealand is simplified: the history of occupancy of all mammal species is comparatively short, and the number of potential competitors are relatively few. These study opportunities have yet to be exploited.

The subject of predation is an especially interesting one to study in a country where both prey and predatory mammals have been introduced. In general, prey-predator relations are somewhat more simplified than in continental areas, either because of a smaller choice of prey species by the predator, or because of fewer potential predators on a given prey species, or due to a combination of both of these factors.

Three examples are given as typical of situations available to future New Zealand students of predation.

(1) One of the most interesting experiments involving predators (especially ferrets and stoats) and a prey species (the European rabbit *Oryctolagus cuniculus*) has taken place in New Zealand. "These predators were protected by the Rabbit Act of 1881, and from 1882 to 1897 tens of thousands of ferrets, stoats and weasels were introduced from Britain" (Thomson and Worden, 1956). The objective was to control the rabbit by its "natural enemies." According to the same authors, "No noticeable decrease in rabbits was observed, but protection was not completely removed from the predators until 1936." However, detailed studies of predation are lacking.

(2) In most New Zealand areas containing deer, there are no predators. Shooting normally acts as the only decimating factor in addition to natural environmental controls. There are, however, a few areas in which feral dogs are preying on deer populations. To what extent deer flesh occupies a significant part of the dogs' diet or to what extent these animals are effective as a factor contributing to the stabilization of numbers of deer is unknown.

(3) Also unknown is the effectiveness of introduced predators on either indigenous birds or introduced birds.

Students of seasonal migration in North America are somewhat handicapped by being forced to rely on speculated origins of annual migratory patterns following changes in ice limits during glacial periods and including subsequent shifts in vegetation. In New Zealand these or other postulations are unnecessary, and the seasonal migrations of deer in country new to them can be traced to contribute to our knowledge of migration in general and, for the different species, to the relative importance of environmental or innate causes of these seasonal movements.

For some animals, like the southern fur seal *(Arctocephalus forsteri)*, it may be possible to profit from the considerable experience with similar species in the Northern Hemisphere. This species was exterminated along many parts of the coast and everywhere greatly reduced by about 1825. Under protection since 1894, their numbers have locally increased in the South Island and their range is still spreading slowly north along the southern coasts of the North Island. The fur seal is an important animal to study and provides an opportunity not only to trace the history of the recovery and increase of this species, but to lay the foundations for another facet to the economy of the country. This is an untouched field.

Although similar to opportunities in other countries, several species of native New Zealand birds offer unusually good research opportunities because of the ease with which they can be studied. The following birds chosen as examples are common within the habitats of their preference.

The kea *(Nestor notabilis)*, for example, is an easily captured and highly intelligent parrot and is regarded as a problem in some areas because at least some individuals attack and sometimes kill sheep. In mountainous areas where it is not shot, it is common and is a curious friendly bird whose social organization could easily be studied.

The large native pigeon *(Hemiphaga novaeseelandia)* offers good study possibilities because of its wide distribution and the ease with which it can be observed at close quarters. Three widely distributed birds, the fantail *(Rhipidura fuligonosa)*, the New Zealand tit *(Petroica macrocephala)* and the robin *(Miro australia)* are also extremely easy to approach and lend themselves to population studies because of the ease with which the birds could probably be captured and banded. Fantails, for example, could be easily captured with a hand net.

Faunal changes are unmeasured whether following destruction of the original forest, conversion to pasture and arable land, or extensive development of exotic forests. Large scale changes in habitat associated with conversion of virgin forest to arable farm lands and to pastoral lands have increased the amount of habitat suitable to several native birds; and some of these birds, like the fantail, and the New Zealand pipit *(Anthus novaeseelandiae)* have probably increased in number. Some of the large exotic forests provide nearly ideal experimental conditions for biologists interested in describing changes in an entire vertebrate fauna associated with changing habitat. For example, in the largest exotic forest, Kaingaroa forest, approximately 250,000 acres have been planted with conifers since the beginning of the century. This area is divided into over 1,000 compartments, each with a single tree species and many a mile square or over. Blocks in all stages of succession are present, including regeneration of new crops following clear felling. The entire area is carefully supervised. Examples of mammals present in this forest, in addition to populations of native and introduced birds (including pheasants and quail), are three species of deer, hares, rabbits, an Australian marsupial, the brush-tailed possum *(Trichosurus vulpecula)* and feral pigs and horses.

Eight species of penguins have been recorded on the coasts of New Zealand (Flemming et. al., 1953), and four of these are common in different parts of the islands. One of these species, the yellow-eyed penguin *(Megadyptes antipodes)* has been studied in detail (Richdale, 1951), but the other four species are little known although common in different parts of New Zealand. Penguin nests are easily located and are fairly accessible even near large centres of population. Several hundred blue penguins *(Eudyptula minor)* live inside Wellington Harbour, for example, and during their nesting season some pairs become nuisances by calling at night under houses close to the beach.

The introduction of an entire mammal fauna into an area previously unoccupied by mammals is unique in history and is not likely to happen again, for New Zealand is the only place of its size with suitable environment that has not been previously inhabited by mammals, apart from two species of bats. At the time of writing and for the next few years, several species of birds and mammals will continue to disperse into environments previously unoccupied by these species. It would be hard to imagine a finer opportunity for study of the mechanism of dispersal of individual species. Such studies in the future should throw new light on the mechanism of dispersal involved in any vertebrate population. This basic opportunity arises from the fact that we know what species were liberated where and when and can trace their subsequent spread. At present this is difficult within New Zealand because of the small number of persons interested or in a position to help with adequate recording. Ideally the studies should be done within the next few years while the spread is continuing and before a new adjustment between the introduced population and the new environment (in itself another important avenue for study) becomes established.

Of the 31 bird and 27 mammal species established in New Zealand, how many were successful and have not come in conflict with human interests, and how many have become problem animals? The great publicity attached to the few animals that have become classed as pest or "noxious animals" has given rise to a common New Zealand belief that all introduced animals are "noxious." Yet few New Zealanders object to introduced birds in the city parks and gardens, to the spring songs of skylarks in the fields, or to chaffinches and redpolls in the remote forested areas. Of ten species of deer liberated, two were unsuccessful and only three of the remaining eight species are regarded, locally, as problem animals. As has been suggested in a recent publication (Riney, 1956), even the red deer is not necessarily a cause for serious alarm wherever it occurs.

This suggests the need for re-examination of the axiomatic belief that the native vegetation of New Zealand evolved without browsing and grazing pressure and therefore without appropriate resistant mechanisms. The present time is ideal for a critical examination of this belief as it

is still possible to measure adjacent disturbed and undisturbed environments while the animals are spreading, and to compare them with areas in which populations have achieved a measure of stability.

Several domestic animals have become feral. Aside from the dog mentioned above, the domestic cat, pig, goat, cattle, sheep, horse, turkey and goose have established free ranging populations. Little research has been done with any of these animals. Especially for larger feral mammals it should be important to study the populations as if they were wild animals to learn something of their ecology in the absence of animal husbandry. What niche in the environment do they occupy when left alone by man?

Dr. L. R. Dice (1955) has stated that it is safe to assume that a human community differs from a natural community mainly in its greater complexity, and in the degree to which it is dominated and controlled by the single species, man. "We can safely assume that the laws of biology, and especially those of ecology, apply at least in part to the communities of which man forms a part, even though every human community is very much more complex than any community which does not include man as a member." This observation is typical of statements of a number of pioneers in the fields of geography, natural history, agriculture and economics who are aware of the importance of contributing in no matter how small and trivial a way to the increasing body of knowledge of human ecology.

How does this concern New Zealand?

New Zealand offers the student of ecology, including human ecology, comparatively simplified ecosystems to study. These ecosystems range from those with very few introduced vertebrates present and not directly influenced by man (it is still possible to visit unmapped, unexplored areas in New Zealand) through forest areas in the process of being converted to pastoral or arable farm lands; to highly developed agricultural lands with a history of European occupancy of just over 100 years. Compared with northern hemisphere continental ecosystems, the study opportunities in even the most complex New Zealand areas are relatively simple. If advantage is taken of these opportunities before existing study areas become increasingly complex through the continual addition of biological changes, a valuable contribution may be made to the newly expanding field of human ecology.

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How to Edit a Professional Journal—and Survive

HENRY CLEPPER

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THE workaday life of the editor of a professional, scientific, or technical journal is usually torn between two mental states, happiness and harassment—roughly in the proportion of ten to ninety. It is the ten percent that gives zip and sparkle to what would otherwise be coolie labor.

I think of the editors of literary magazines, such as the *Atlantic* and *Harper's*, as eminent men of letters, which of course they are. I imagine them pursuing their interesting duties in richly appointed offices with Oriental rugs underfoot and surrounded by objects of art, in a hushed and softly lighted atmosphere from which the fragrant odor of Corona Coronas is drawn off by concealed and noiseless air condition. But this is probably pure fantasy. Never having been in one of these literary sanctums, I am just guessing.

However, I do know something about the editorial offices of professional and scientific journals, having worked in one for enough years to acquire a slight stoop and bifocals, and having visited numerous others during a writing and editing career that has not been without its compensations—other than financial, of course. Let me describe such an office and the singular creatures who inhabit it. Be it understood, I write now of the male of the species, though I am not unaware of the splendid contributions rendered by the several women editors of professional and scientific journals; and especially the hard-working stenographers and typists who, year in and year out, perform indispensable yeoman service. If the editors comprise the *corps d'elite*, the stenographers and typists are the indispensable shock troops of the crusade for science.

To come to the point, the typical office of a professional journal is as different from my mythical description of the editorial sanctum of a great literary magazine as is the actual laboratory of a research work from the technicolored splendor of a Hollywood movie's conception of the scientist's milieu.

Editors Are Human Too

Enter with me the editorial office of a professional journal, perhaps your own, a monthly periodical, not of large circulation, having several thousand fewer subscribers than its importance deserves. It is a cluttered place. Books and magazines overflow from crowded shelves. More than likely, the editor shares his cubicle with a secretary, who is behind in her work (a chronic condition) and who, therefore, cannot be expected to stop the clattering of her typewriter simply because visitors have dropped in. There is no subtle odor of Havana cigars. Instead the nostrils are assailed by an effluvium, not unpleasant, composed of the editor's venerable pipe, the secretary's cigarettes (informality prevails here), and library paste. Desks and tables are strewn with papers, clippings, galley proofs, scissors, pastepots, and other impedimental of this esoteric craft.

The editor clears two chairs, invites us to sit down, lights his briar, and eases back for a little chat. If he seems slightly remote and inattentive at times, it is not due to lack of courtesy. This morning he received three bitterly critical letters from readers, and two complaints from contributors whose articles had been submitted months ago but hadn't been published. The printer had failed to deliver proof on the date promised. A typographical error had just been discovered in last month's issue too late to correct because it was then in the mails. (The misadventures of editing are invariably of major, never minor, importance.) Moreover, he is even now faced with that recurring, ulcer-producing, bugbear of all publishers, everywhere, at all times—a deadline.

We shall not stay long. Our host is obviously so preoccupied that we withdraw

on completing our business and leave him to his chores and worries. But let us not make the mistake of considering him an object of pity. As a matter of fact, we have just left a reasonably happy and contented man. He likes what he does and does it well. If his salary is such as not to inspire the envy of a master plumber or a TV repairman, he has other compensations that we may only dimly appreciate.

To counterbalance the irritations of the day, he has received a friendly letter, more precious than rubies, complimenting him on an especially interesting issue several months past. A well-written, well-organized, well-illustrated article has come in; it announces a practical and original technique, one that should create a certain stir in professional circles. He is enthusiastic about it. An author whose paper had to be severely cut and edited, instead of taking umbrage, actually had the courtesy to thank the editor for improvements made in it. Finally, the delayed proofs have at long last arrived from the printer.

Thus let us leave our editor, absorbed and intent on his proofs, with pencil poised, ready to pounce on the misplaced comma and the transposed letters. He is a man perfectly adjusted to his environment, living a somewhat lonely existence but always consciously producing for others, and incurably optimistic for, by the psychological nature of his profession, he lives only in the present and the future, never in the past. If he has an enemy in the world it is the dangling modifier, that illogical and confusing verb form that is one of the commonest grammatical mistakes made by writers, scientific or otherwise.

The Editor as Middleman

Like a retailer who deals in the distribution of goods to the ultimate consumer, our editor is the middleman between the writer and the reader. He blends certain ingredients into a product that has recognizable standards even though it may vary in form from month to month. Dozens of papers may be sent him every week. In the final analysis, his major problem is one of selection.

Even if he himself reads all the articles directed to him, he probably lacks the specialized knowledge to appraise the technical accuracy of but a portion of them. Consequently, he may be assisted by several part-time collaborators who are specialists. Frequently, on journals of small circulation such assistant editors render their services gratuitously as a professional contribution. Manuscripts that survive the critical scrutiny of one or more associate editors finally reach the editor's desk where, after careful examination and editing, they are sent to the printer.

An editor works on a rigid schedule. For each issue, his publication must be ready for the printer on a certain designated date. Accordingly, he makes his plans well in advance and has an ample supply of accepted articles in print far ahead of time. His aim is to select for each issue a well-balanced variety of articles—in short, to provide something for everyone. The marvel is not that he succeeds every time, for he doesn't. It is that he succeeds as often as he does.

The "Compleat" Editor

An ancient writer on the art of war once drew up a list of the qualities which go to make up a "compleat general." In most details it applies equally well to the "compleat editor."

"A general must be continent, sober, frugal, temperate, industrious, and a good man of business, cautious and prudent; he must despise money . . . he must be not too young and not too old; and he must, when occasion arise, be eloquent." (There are still people who doubt the value of a classical education!)

Among the important aspects of editing are those having to do with the mechanics of the job. As in most work, skill comes with experience. An understanding of the uses and limitations of linotype machines, type faces and sizes, engraving, proofreading, "make-up," and other routinism is not hard to acquire. But knowledge of these matters, however comprehensive, does not qualify one to be an editor.

Nor are mastery of the English language and ability to write it clearly and grammatically paramount qualifications, though their lack will forever prevent one from becoming an editor, at least a good one.

Perhaps the most necessary qualification for an editor of a professional or technical periodical is thorough education and training in the specialized field covered by the publication. A sound knowledge of closely related fields is also desirable; in fact, it may be essential.

But there is more to it than that. An editor must have a positive flair and aptitude for the job, something that is easier to perceive than to define. He must be able to detect the basic dross in a paper, regardless of how eminent the reputation of the contributor, when it is largely a rehash of old facts supported by some highly personal though not necessarily sound opinions, all held aloft by a long and impressive bibliography, like the tail of a kite.

Contrariwise, the good editor must be able to detect paydirt in most unpromising ore. Every editor receives an occasional paper so amateurishly written and so poorly organized that it practically invites rejection. Yet on second reading, he finds that the subject is of more than casual interest, the data reported are factual, and the conclusions are fundamentally sound. In short, with some rewriting and considerable editorial guidance, the paper is worth salvaging. He goes to work on it with the hope and enthusiasm of a canny prospector who has located a likely uranium deposit.

But even this is not all. Our typical editor must be a specialist in human relations so as to be able to calm, if not satisfy, the irate reader and the complaining contributor, who may, and frequently do, have justifiable gripes. In a magazine with an editorial content exclusive of advertising of, say, eighty pages, there may be between 50,000 and 75,000 words, not to mention illustrations, tables, graphs, and charts. Hence, there are as many possibilities for errors as there are words, and all the skills of human ingenuity bolstered by sacrifices to the gods do not prevent mistakes.

An editor may be wholly without superstition, yet he cannot help but wonder at times whether he is not plagued by gremlins who mischievously transpose lines of type, shift decimal points, mislabel illustrations, and in general raise the devil with print. (I am not speaking of a printer's devil; he is another species.) Depending on the point of view, one subscriber may be provoked that there are any mistakes at all, whereas another may marvel that there are so few.

Consequently, our editor must be constantly concerned with what Somerset Maugham calls "an exaggerated insistence on insignificant details." Such insistence pays off when chemical and mathematical formulae and Latin names come out correct in print.

Editorial Shoals and Reefs

Few professional journals, including those issued by commercial publishing houses, can afford to pay space rates. Doubtless, this is why accepted articles are euphemistically called contributions. Fortunately, publication of a paper in such a journal is usually viewed by the author as an honor conferred, or at least a form of recognition of his work, which indeed it frequently is.

Some journals even require payment by the author or his employing institution of a publication charge based on the number of pages printed. Others require payment for plates and tables. In a few cases, the periodicals do not customarily require payment, but on an author's agreement to bear the publication costs his article will appear immediately.

Manifestly, writing for professional journals is not a lucrative occupation. On the other hand, many a professional worker has indirectly benefited from his gratuitous contributions to journals. In the case of research workers and teachers, promotion in salary may be dependent on their productiveness as authors. And professional people self-employed often find their business or clientele increased as a result of heightened reputation gained through their writings.

Numerous journals, including my own, have experimented with the device of offering money prizes for the best article published during a given year. On the face of it, this scheme appears to offer splendid possibilities for rewarding and giving recognition to talent. But it has pitfalls. Prize committees are often hard put to it to make the selections. (After all, what is the "best"?) Occasionally, a wealthy donor will offer a cash prize for the best paper on a specified subject. Here, too, are booby traps for the editor. The chosen article may be the best only in the opinion of the selection committee and the author. It

may or may not impress the donor, in which event the prize may be awarded once and then dropped.

A common fallacy believed by the general public, and, strangely enough by some scientists and technicians, is that professional journals are valuable publishing assets, which they frequently are, and that they make lots of money, which with a few notable exceptions they don't. A survey by the National Science Foundation several years ago showed that the average circulation of 110 scientific and technical journals studied was 6,000, ranging from less than 500 to more than 60,000. Financial problems were a serious concern to all, no less to the large ones than to the small.

The Genus, Author

In the matter of the relations between editors and contributors much has been written—often in sorrow and anger. Your editor is neither a capricious nor an arbitrary individual. Admittedly, he may have only the most rudimentary knowledge about, say, galactan, a hexosan which yields galactose on hydrolysis and which is abundant in *Larix occidentalis*. But his experience tells him that a table, a graph, and a description in the text, all of which demonstrate exactly the same thing, are excessive if not tautological.

This kind of author, however, creates no insoluble problems; the editor handles them everyday. Often they end by becoming friends and getting on a first-name basis. The problem children in the editor's family are of another species entirely.

Consider, for example, the case of the crotchety contributor, fortunately for the editor's sanity a *rara avis*. He is the one who submits a sloppy typescript — a smudged carbon copy, single spaced—with illegible revisions written on the margin in a 4H pencil. He mails the paper on October 1, requests that it be published in the November issue, and is indignant when it is not. Never mind if the editor then does a complete rewrite job, corrects the grammatical errors, and properly quotes the misquotations; it is thankless labor. The crotchety contributor's sense of gratitude is minuscule, and he will dismiss the obvious and essential improvements by the assertion, "That's what the editor is paid for."

Next, let us observe the protesting professor. He is perhaps the senior author of a poorly organized paper that is largely the work of an earnest though not necessarily gifted graduate student. There are several variants of the protesting professor, but in their usual manifestations they exhibit one trait in common—a stubborn unwillingness to do the additional work on the paper needed to make it acceptable for publication. Instead, the protesting professor complains first to the editor, than to the editor's employers, explaining that he knows more about the subject than the editor does, which may be true; that he has been writing articles, and books too, before the editor was (1) born or (2) dry behind the ears, which may also be true; and finally that the editor is a dunce. This last accusation is palpably defamatory and false. But by this time the editor seeks peace at any price. He rewrites the paper, possibly spending more time on it than the author did. When the article is published at last, may we assume that our protesting professor has been mollified and is now grateful? Alas, we may not. He will forever hold the opinion that the editor is a dunce.

Third, we have the absent-minded author. Likely as not, he is the type that fails to keep copies of correspondence or even the simplest business records, with bizarre results. One day out of a blue sky, so to speak, a thunderbolt strikes our editor. The absent-minded author demands to know why the article he submitted six months ago has not been published. Moreover, he has yet to receive the courtesy of an acknowledgment, which indicates that the editor is not only inefficient, he is lacking in common politeness to boot. The absent-minded author threatens to complain to the editor's superior officer, and does. Our bewildered and unhappy editor drops everything and institutes a search for the missing manscript. It not only cannot be found; there is no evidence that it had ever been received. At length, our editor deduces what happened and the absent-minded author sheepishly admits it. He forgot to mail the article in the first place.

You think I exaggerate, dear reader? Similar illustrations could be prolonged indefinitely. They are cited, not as typical examples of the editor's relations with contributors, but to indicate that the editor's job, regardless of what else it may involve, is fundamentally one of dealing with people. Fortunately, most editors have reserves of fortitude and humor to cope with such situations. Even when they are the subject of bitter and often unjustified criticism, they may take a detached view and observe with fascination, if not with pleasure, the eccentricities of human behavior as occasionally displayed by the genus author.

The Summing Up

Your "compleat editor," as I know him, is an affable, friendly individual, long suffering but forgiving, ready and willing at all times to be of service to author and reader.

He believes that the literature of his profession is one of its most precious assets for it is the permanent record of the growth of scientific and technical knowledge. Within his power and limitations he strives to assure that his journal shall fulfill its principal responsibility—not only keep abreast of new knowledge, but to keep in advance of its possible application.

Often working with an insufficient budget, insufficient assistance, and insufficient compensation, he is nevertheless a dedicated and reasonably happy man. The proof is that he is primarily devoted to his profession and not to its emoluments.

An Introspective Critique of Scientific Society Conventions

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NEARLY five years ago (AIBS BULLETIN, July, 1953), Russell Stevens, in his own inimitable and iconoclastic style, set forth a critical analysis of some current weaknesses of science meetings. Dr. Stevens' critiqué represents one man's opinion (albeit by a very analytical mind), and since many other rumblings of dissatisfaction have been heard (not in print, however) it seemed desirable to find out just what the entire membership of at least one member society of the American Institute of Biological Sciences thinks about their annual national conventions. Since there is good reason to believe that the issues involved are shared by other AIBS societies, the results of a public opinion survey[1] of the American Phytopathological Society membership on questions pertaining to that society's national conventions are herewith presented. Over 1700 copies of a questionnaire, containing 31 questions, were sent out to members all over the world. More than 700 returns were received, which is a better than average response for questionnaires, especially considering that nearly all of the members outside of North America did not respond, for obvious reasons. Quantitatively and qualitatively the response must surely be indicative of the current interest and need in improving our scientific meetings. All of the respondents did not answer all of the questions since they were instructed to omit replies to questions which they felt incompetent to answer. Nevertheless, the

[1] In 1956, the Council of the American Phytopathological Society authorized the writer to make a survey of opinion of the membership relative to its national conventions, and this survey was carried out during 1957, while the writer was President of that society. The questionnaire for this purpose was formulated with the help of members of the Council.

response was very gratifying. For some questions comments were solicited. When all of these, plus unsolicited comments, were lifted from the questionnaire returns and assembled into typewritten form, they totaled nearly 150 pages of doubled spaced typing! This compilation of comments has indeed made interesting reading.

The returns were grouped into four categories, based on how many meetings the respondents had attended during the past 10 years: 0, 1-3, 4-6, 7-10. It was thought that there might be significant differences of opinion and viewpoint on this basis, but in general this did not prove to be the case. Only the results on questions deemed pertinent to other AIBS societies are included in the following summary.

1. Indicate your individual rating of the importance of the following purposes served by our national convention (1 to your first choice, 2 to your second choice, etc.): (A) Exchange of information (by attending and participating in paper sessions); (B) Job contacts (interviews between prospective employer and employee, to get leads on jobs, on men to fill jobs, etc.); (C) See and visit with old friends, renew acquaintances, etc.; (D) Opportunity for personal conferences; (E) Opportunity for graduate students and younger members in general to meet and become acquainted with the older members whom they know only by reputation, and to more quickly develop a more professional "attitude".

Of the above purposes, (A) was an obvious first choice among all four attendance groups. (D) was second, followed by (C), (E) and (B) in that order. In other words, the tabulation of the results on this question, plus pertinent comments, indicates that the primary purpose and value of our national conventions still is the exchange of information, but nevertheless a strong vote of popularity was registered for the value of our national conventions as a means of personal conferences and as an opportunity to visit with friends and to renew acquaintances.

2. Do you feel that we are trying to accommodate too many papers at our national meetings?

Yes—424; No—175. A substantial majority of the membership voting on this question therefore feels that the national meetings are crowded with too many papers.

3. Would you suggest we reduce the number of papers scheduled at the national conventions?

Yes—423; No—164. As might have been expected, this is essentially the same vote as occurred in the preceding question, with the same proportionate response in the different attendance groupings of the membership.

4. If so, how? (Mark your choice in 1, 2, 3 order): (A) Reduce the limit from two to one paper per member, including sole, senior or junior authorship; (B) Screen out low quality papers; (C) Both (A) and (B) above; (D) Encourage more presentation of papers at divisional meetings.

All of the above methods found considerable favor among the membership as a whole who voted on this question. However, a definite first choice was indicated for (C) with (A) and (D) tied for rather close second place. (B) by itself found the least favor because, as was repeatedly expressed in the comments, of the difficulties and dangers involved. Many acknowledged that there are indeed low quality papers but raised the question as to who among the membership would have the judgment and would accept the unpopular responsibility of doing the necessary screening.

5. Do you think it would be helpful to limit all papers to ten, seven or five minutes with 2-5 minutes scheduled for discussion, instead of the present maximum of 15 minutes with no scheduled time for discussion?

Yes—416; No—216. This 2:1 vote for reducing the maximum length of papers was uniform in all four attendance groupings of the membership. The majority vote went to the ten minute maximum.

6. As another approach to the alleviation of a crowded three-day program would you favor a four-day meeting in which the subject matter sessions were arranged so that very few members would need to attend more than three days?

Yes—323; No—268. Thus, while the majority have indicated a preference for such a four-day meeting, it is not a very impressive majority. Opinion was quite equally divided in the 4-6 and the 7-10 groups, while the 1-3 group showed a substantial preference for the four-day meeting and the majority of the zero group were against the four-day meeting.

7. Do you feel we have too many concurrent paper sessions at our annual national convention?

Yes—349; No—196. With the exception of the 7-10 group the voting was clearly 2:1 that we are indeed having too many concurrent paper sessions at our national conventions. Many respondents commented to the effect that while they believe we are attempting too many concurrent sessions, they see no way of alleviating this situation as long as we try to accommodate as many papers as we do.

8. How many of the separate subject matter sessions interest you, whether or not they are concurrent? (We now have 15-20 and these were listed).

Throughout all four of the attendance categories a good majority of the votes indicated an interest in 5 or 6 of the subject matter groupings.

9. Do you think we are trying to crowd too many papers into the individual paper sessions at our national conventions? (For instance, at our recent convention in Cincinnati, several of the individual sessions had as high as 16 or 17 papers for a single morning or afternoon).

Yes—415; No—118. Here we have a clear cut expression of opinion against so many papers per individual session, and the comments received on this question certainly substantiate the vote. One respondent said, "I was a chairman at Cincinnati for a 17-paper session and it was a horrible experience." Many of the comments were rather caustic in their criticism of such crowded paper sessions.

10. Would you prefer to see more time allowed for discussion?

Yes—371; No—195. Here we have a 2:1 vote at least to provide time for discussion, whether or not it is utilized. However, many respondents, while voting for more time for discussion, qualified their opinion by saying that the questions and discussion should be spontaneous and genuine rather than artificially generated by excess solicitation from the chairman. Many expressed the opinion that most papers do not merit discussion. Others opined that some papers are so specialized that very few in the audience understand them well enough to ask questions. Nevertheless, a wish was expressed by many for more papers that do stimulate thought and discussion, and they felt that this can be as valuable as the paper itself.

11. Should the session chairmen be instructed to be *more strict* in holding speakers to their allotted time?

Yes—543; No—58. Here indeed is a very clear cut mandate to the chairmen of these paper sessions to hold speakers strictly to their allotted time. The strength of this vote is fully substantiated by the quantity and quality of the pertinent comments. The suggestions to the chairmen for making speakers adhere to their allotted times are legion and would make a manuscript by themselves. Alarm clocks, timers, light signals and other means of keeping time on a speaker and to warn him one or two minutes before the end of his time were predominate among the suggestions. Of particular merit would seem to be the repeated suggestion of some means to warn the speaker without embarrassing him. This would involve some signal, at the podium, or elsewhere concealed from the audience, and operated by the chairman. One respondent suggested that the only materials needed would be a small flashlight bulb, a dry cell, a push-button switch and ten feet of wire. Also prominent among the suggestions is that the beginning of a session the chairman remind the speakers that they are morally obligated to adhere to their time limits and that the chairmen are obliged to enforce them.

12. Approximately how many papers did you hear at the last national convention of the APS you attended?

The replies on this question were divided into 11 categories, based on increments of five papers, from five or less to 50 or more. In all of the attendance groupings, the category of 16-20 papers was indicated by a majority of the respondents. Of 550 replying to this question, 100 indicated that they had heard 16-20 papers. The rest of the tabulation was well scattered over the other categories, with 15 admitting that they had heard only five or fewer papers, 80 had heard only 6-10, while 46

faithful members heard 50 or more papers at the last convention they attended!

13. Roughly, what percentage (100%, 75%, 50%, 25%, less than 25%) of the papers presented at our national conventions do you think are good?

This is admittedly a dangerous question to ask and the expected snide comments on "What is 'good'?", "All of them were good for somebody", and similar qualifications were received in abundance. Nevertheless, 510 respondents gave an evaluation, and of these, three thought that 100% of the papers they had heard were good, 113 indicated 75%, 186 said 50%, 119 indicated 25%, and 69 thought that less than 25% of the papers they had heard were good. Considering that in the tabulations of all of the attendance groupings, there are more votes below 50% than above, it appears that the average opinion of the membership voting on this question is that less than 50% of the papers can be considered good. The purpose of this question, of course, was not to arrive at any statistical analysis of goodness among the papers presented at our national conventions, but to attempt to arrive at some general appraisal of their average quality.

14. In general, do you feel that the "oldsters" should refrain from presenting papers so as to provide better opportunity (i.e., more audience, more time for presentation, more time for discussion, etc.) for the "youngsters"?

Yes—50; No—547. This vote and the accompanying comments certainly are eloquent in opposition to the suggestion one sometimes hears that the older, established scientists should make room on the program for the younger ones who are striving to establish themselves. The opinion was quite generally expressed that the criteria for accepting papers for the program should be based on the nature and quality of the material to be presented, and not on the age of the speaker. Many expressed the opinion that the "oldsters" are looked to by the "youngsters" to set the example for quality of papers, both from the standpoint of subject matter and the technique of presentation. It was expressed by some that the oldsters tend to "ride on their reputation" and appear to give less time toward preparation for the presentation of their papers.

15. Should we continue or discontinue our present tradition of annual dinner and program?

Continue—504; Discontinue—60. Besides this overwhelming vote of confidence for the annual banquet, there were many favorable comments on the general value of the banquet and a good attendant program of entertainment.

16. Do you think $5.00 per plate is excessive for the annual banquet.

Yes—350; No—210.

17. How much do you think the upper limit should be?

Of the 390 persons expressing themselves on this question, 225 placed the upper limit between $3.00-$4.00, 75 thought it should be less than $3.00, and 13 were in favor of the banquet costing above $6.00. One of these was a graduate student, indicating the upper limit at $10.00! The great predominance of opinion, however, throughout all four of the attendance groups, was for a banquet to cost not more than $4.00.

18. Do you prefer general levity, general seriousness, or a combination of both at our annual banquet?

Of the 572 voting on this question, 37 voted for seriousness, 108 for levity, and 427 for a combination of the two. Many expressed the need for levity after so much seriousness during the paper sessions and the business meetings, but cautioned against "low-brow" levity. "Fun with dignity" is the desire expressed by one, with similar comments by many.

19. What kind of entertainment do you consider appropriate at our annual dinner? (A) Leave it up to the local committee; (B) No entertainment; (C) Erudite speeches; (D) "Long-hair" musical programs; (E) Light and frivolous musical programs.

Of the 648 responses on this question, 447 were for (A) above, 116 for (E), while (B), (C) and (D) found very scant favor indeed. It appears certain that the great majority are quite willing to leave the entertainment up to the local committee, but they definitely want it understood that they want no "stuffy" programs.

20. At our national conventions, how do you think the evenings should be spent? (A) More paper sessions and/or symposia; (B) Left open for informal personal conferences.

Of the 588 opinions expressed on this question, 429 were in favor of leaving the evenings open for informal or personal conferences, and only 159 were in favor of more paper sessions or symposia. Of the latter group, however, a definite preference for symposia was expressed. In fact, throughout the entire questionnaire there was a general clamor for more symposia and not so many individual scientific papers. Some indicated that they would not object to paper sessions or symposia in the evenings if they did not carry on far into the night.

21. Indicate your general preference of media for our national conventions by underscoring one: hotels in convention cities, college and university campuses, "resort" places (like Estes Park, for our 1954 meeting).

On this question 519 expressions of opinion were received; 255 were in favor of college and university campuses, 156 were for hotel meetings, and 108 preferred resort places. The comments received indicated quite definitely the advantages and disadvantages to all three of these meeting places. It was repeatedly pointed out that hotel meetings have the very definite advantage of having the meeting rooms all closely and centrally located so that one may go from one to the other with an ease not provided by campus meetings where the different sessions are apt to be widely scattered. On the other hand, the ever-increasing cost of meeting at hotels was deplored. Many pointed out the desirability of rotating our meetings as we have been doing and to occasionally include a resort location.

22. Indicate your preference of meeting: (A) By ourselves; (B) With AIBS; (C) With AAAS; (D) With Entomological Society of America; (E) With American Potato Association.

Of the 711 responses on this question, meeting with the AIBS is established as a first choice, with 317 votes. Meeting alone is preferred by 256 of the respondents, and 105 prefer meeting with the AAAS. Only 61 and 72 indicated a preference for meeting with the Entomological Society of America and the American Potato Association, respectively. The numerous comments on this question indicated that there is quite general favor of the present policy of more or less rotating the national meetings with other organizations. Some old, familiar objections were voiced against Christmas-time meetings, and some pointed out the disadvantages that arise when a Christmas-time meeting with the AAAS is followed by a late August meeting with the AIBS, this resulting in a short year and too little time in which to get any new data analyzed and prepared by the time abstracts are due.

23. Does your institution, agency, employer, etc., require that you present a paper in order to be eligible for: (A) Partial travel expenses; (B) Full travel expenses; (C) Reimbursement not influenced in this way.

Of the 595 persons responding to this question, 412 indicated that their reimbursement for travel to scientific meetings is not influenced by the presentation of a paper, and 183 indicated that their policies of reimbursement require that they do present papers. Of this latter group of 183, 79 indicated that they receive full reimbursement and 104 receive partial reimbursement.

From these results it is seen that nearly 1/3 of those who replied to this question indicated that in order to receive reimbursement for expenses of travel to scientific meetings they must present a paper or papers. In many cases throughout the questionnaire returns the statement was made to the effect that if administrators could be persuaded to abandon the nefarious practice of requiring presentation of a paper before any reimbursement can be authorized, then the quantity of papers submitted at our national convention would decrease and the quality would increase. By inference, or by direct statement, the opinion was expressed repeatedly that just the very economics involved would tend to influence an individual to "throw together" some kind of a paper in order to qualify for reimbursement. The artificiality of such a policy is obvious.

The returns on this question bring to light a wide range of policies and practices obtaining at various institutions and agencies on the matter of reimbursement for travel to scientific meetings. Some

institutions have the policy of granting no reimbursement whatsoever, regardless of the rank and position of the individual and regardless of the nature and extent of his participation. In other cases, full reimbursement is given, without participation of any kind being required. Between these two extremes lie several intermediate policies.

Summary and Conclusions

1. Based on excellent questionnaire returns, it is the opinion of a very substantial majority of the membership of the society within which this survey was conducted that, as a natural and unrestricted result of growth and development, our national conventions have become congested with too many scientific papers and too many concurrent subject matter sessions. The same majority believe that something should be done about the situation and the following means have found favor:

A. Reduce the limit from two to one paper per member, including sole, senior or junior authorship.
B. Screen out low quality papers. This is considered to be a responsibility of the department head or similar administrative officer rather than for a "screening committee" selected from the membership itself.
C. Both (A) and (B) above (this was the top choice in the returns from the questionnaire).
D. Urge more presentation of papers at the annual meetings of the geographic Divisions of the society. In the case of one Division there is a policy against any paper sessions at all, thus throwing a disproportionate burden on the national meeting.
E. Fewer papers per session with more time for questions and discussion.
F. "Educate" administrators that the practice of making reimbursement, whether in full or in part, contingent on the presentation of a paper or two may well contribute toward increasing the quantity and decreasing the quality of the papers presented.
G. Reduce the present 15 minute maximum presentation time to 10 minutes.

2. Time should be called strictly on speakers, with the chairman being ruthless if the speaker is thoughtless enough to force the chairman to be so.

3. Rehearsal of papers before a critical "home" audience is a practice at some institutions and is recommended for universal adoption. This should be done sufficiently in advance of the convention to enable speakers to take advantage of constructive criticism, in which attention should be given to all of the details which contribute toward good presentation. Such a "dress rehearsal" not only improves the presentation at the meeting itself, but also contributes toward the speaker staying within his allotted time.

4. A substantial majority of the membership believes that, except for the annual banquet, the evenings should preferably be left open for informal conferences.

5. Considerable desire was expressed for more symposia, in the evenings if necessary, but not for more paper sessions in the evenings. The symposia, staged by recognized authorities in the various fields, are considered to be an efficient means of helping keep abreast of the general field, rather than just one's own particular little specialties.

6. There is considerable room for improvement in the quality of the papers presented at our national conventions. The opinion expressed in the questionnaires would indicate that less than half of the papers are considered to be good. "Quality" is deemed to include both subject matter and presentation, and should be a matter of pride with the individual and a joint responsibility with his immediate administrative superior. Considerable opposition was expressed against papers which are merely progress reports, current fungicide tests, and other papers that are of a "continued story" nature, and which are considered more appropriate for divisional meetings.

7. There is overwhelming opinion that we should continue our present tradition of the annual dinner and program. Most felt that $5.00 is a little too costly and that the upper limit should be around $4.00.

8. A great majority prefer a combination of levity and seriousness in the program at the annual dinner, but are quite willing to leave it up to the local committee to determine the program.

9. The advantages of and the purposes served by our national conventions are as follows, in the order of importance as rated by the membership: A. Exchange of information by attending and participating in the paper sessions, symposia, etc.; B. Opportunity for personal conferences of a professional nature; C. Visits with old friends and renewal of acquaintances; D. Opportunity for graduate students and the younger members in general to meet and become acquainted with the older members; E. Job contacts (interviews between prospective employer and employee, to get leads on jobs, on men to fill jobs, etc.).

10. Opinion is fairly well divided on the comparative value of meeting with the AIBS, alone, or with the AAAS, with the preference indicated in that order. The same is true with regard to media, except that a preference was shown for college and university campuses over hotels and resorts, although these media did receive a significant number of votes and are acknowledged to have certain advantages.

The dictionary definition of convention is, in effect, an assemblage of persons gathered together for a common purpose. As seen in the foregoing questionnaire returns, the purpose in our case is several-fold. As a direct result of considerable growth and expansion during the past two decades some scientific societies, at least, have reached the place where essentially the same physical and time limitations of the national meeting of two decades ago are being forced to serve the same purpose for a present day membership of two to three times what it was two decades ago. And the result is congestion and confusion, and dissatisfaction on the part of a good many of the members. It seems to the writer that there is a clear mandate from the membership of at least one society to have fewer and better scientific papers at the national meeting, and more well-organized, high-level symposia and panel discussions. These latter might well be devoted to the problems of these rapidly changing times as they affect the different professions which the AIBS societies represent. Finally, with less emphasis on synthesis of knowledge through ever-increasing numbers of scientific papers, perhaps we could begin to devote some time and attention to analysis of the overwhelming accumulation of the knowledge we already have. Analysis is far more difficult than synthesis, but, properly handled through symposia and panel discussions, could constitute an interesting and inspiring purpose of the national convention.

This year it's Indiana . . .

INDIANA UNIVERSITY, BLOOMINGTON

August 24-28 **August 24-28**

Page 30. List of Societies meeting at Indiana.
Page 31. Housing information and advanced registration form.
Page 43. Information about field trips, banquets, hotels and motels.

Reprints: Nuisance or Necessity?

FRED R. CAGLE, *Department of Zoology, Tulane University, New Orleans.*

BIOLOGISTS, not unique in that they distribute reprints, are perhaps different from other scholars in the degree of their dependence on reprint collections in research. The enormous biological literature, larger than that of any other discipline, has brought extreme specialization, has inhibited the development of new research centers, has made extremely difficult the preparation of review articles, has led many researchers to ignore previous work, and has forced haphazard bibliographic research. Many biologists must now depend on reprint exchange as one of their primary bibliographic tools.

A survey of opinion on the value of reprints was made during the preparation of background material for an editors' conference sponsored by the American Institute of Biological Sciences and financed by the National Science Foundation. Information was received from 237 research biologists in 112 institutions (universities and colleges), 82; research laboratories and zoological gardens, 11; federal agencies, 7; museums, 5; hospitals, 5; aquaria and zoos, 2). These biologists represented diverse fields of interest, systematics, 59 (animal 38, plant 21); physiology 18; ecology (including conservation, wildlife management, fishery biology) 48; anatomy, embryology (including microanatomy) 28; genetics, 15; entomology, 20; medicine, 13; anthropology, 7; others, 29.

Only 43 of the 237 indicated that the absence of reprint collections *would not seriously* handicap their research. Of these, 10 stated they would be inconvenienced. Each person stated that his library facilities were adequate without reprint collections. Only 3 of the institutions represented are not established centers of biological research or are not located near great library centers. The fields represented were: systematic botany, 5; physiology, 5; entomology, 5; systematic zoology, 3; agriculture, 3; medicine, 3; ecology, 3; others, 16.

Pertinent comments of persons not requiring reprints included: "Reliance on reprints makes for a restricted outlook. Temptation is too great to use as a crutch," "More trouble to keep up than they are worth," "Easy to devote too much time to reprint collecting. I sometimes think it is one of the diseases of the profession," "Reprint hoarding a bad habit; causes more time lost than gained."

Biologists believing they would be seriously handicapped without reprint collections placed primary emphasis on the saving of time. Forty-two reported this as one of the major values. One leading geneticist stated that, without reprint collections, library research would require three-fourths of his research time. Another biologist indicated that 80 percent of the papers he consulted were in reprint form.

The availability of excellent libraries does not nullify the value of reprint collections. Only 22 persons reported that reprints were essential because of inadequate library resources. However, many emphasized that library service was inadequate. Thirteen emphasized that libraries were slow; 15 complained of library restrictions on use of material. Many of the scientists stressing inadequacy of library service are working in institutions having outstanding library resources. Difficulties in the use of libraries reflect problems created by the vast literature of biology. Twelve researchers from great library centers emphasized that many journals of limited distribution, especially obscure and foreign journals, were not available.

The major reasons for maintenance of reprint collections involved convenience of use in both research and teaching. Ten persons indicated that the reprint was of much value in teaching. Others reported these values: ready, immediate reference; many papers could be consulted simultaneously on desk (impossible with bound volumes); reprints may be marked and easily transported; reprints expedite exchange of ideas.

Such often repeated comments as, "Could not keep up without reprints," "Most useful form of literature," "My only hope to know my field," make evident the dependence on reprints.

The strongest argument advanced against the "reprint system" is that it leads research biologists to a limited viewpoint and restricts their acquaintance with many papers pertinent to their research. Most researchers receive reprints only from biologists interested in a specific subject matter area. Too, reprints are received in sufficient quantity that their study often consumes all of the available reading time. In this sense, a biologist's knowledge may merely reflect the extent of his reprint exchange—not the extent of current research. Some scientists may avoid this pitfall; the busy scientist often does not. Yet the biologist's most useful knowledge may come from browsing in related fields.

Indeed, reprints are often a nuisance. The amateur may "collect" reprints as an avocational substitute for stamp collecting. The young researcher must build rapidly his reference library of separates. These two groups bring a multitude of reprint requests to the active worker who may ignore them or spend the time and money to forward reprints. The former action may be discouraging to a potentially competent investigator; the latter will often bring additional requests.

Of the 167 persons indicating the number of reprints they distributed, only four distributed none; twenty-two distributed 50; thirty-five, 100; fifty-nine, 200; twenty-one, 300; seven, 400; nine, 500; three, 600; two, 700; one, 800; and four distributed in excess of 1000.

The results of this survey indicate that the reprint collection is a valuable bibliographic and teaching tool. The reprint will be a necessity for most biologists until our libraries can keep up with the growing flood of biological publication and provide special services to the biologist. Undoubtedly, the basic problem is how to inhibit the ever increasing amount of publication. But we have no solution to this problem.

The dependence of many biologists on reprints suggests that many of our serials should consider abandonment of the journal format and publish papers as separates. Each member would have the privilege of requesting a specified number of pages each year. This system should reduce costs and permit each biologist to procure only those papers of concern to him. The problem of storage and filing would be simplified. Such a system is now used in the field of engineering.

Few libraries of North America receive more than ten percent of the biological serials. Reprint collections cannot replace excellent serial collections but are the only practical, present means for most biologists to gain ready access to a substantially larger segment of the world literature. The notorious literary provincialism of American biologists can not be wholly remedied but more active reprint exchange will improve the situation.

The biologist can expedite his research and be more cognizant of the world literature through development of an active reprint exchange with his colleagues. Such exchange not only provides current papers of his colleagues more rapidly but also stimulates the exchange of correspondence, and thus ideas, with his foreign colleagues. Often reprints will be received months prior to their listing in bibliographic sources. Too, papers are sometimes received that are never listed in the primary bibliographic sources.

The saving in time reported by those using reprint collections suggests that agencies and universities supporting research should implement the development of reprint collections through financing the procurement and distribution of reprints. The biologist should not be compelled to personally finance this bibliographic resource.

But the reprint system must be considered only an "emergency" measure. The library-research problems of the scientist will not be resolved until: 1. scientists accept primary publication in microform; 2. automatic retrieval mechanisms combined with inexpensive microforms are perfected and in wide use.

JOINT MEETINGS OF BIOLOGICAL SOCIETIES SPONSORED BY THE AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

Indiana University, August 24-28

INDIANA UNIVERSITY AUDITORIUM

LOCAL ARRANGEMENTS COMMITTEE *Chairman:* Dr. David G. Frey

Organizations and Representatives

American Bryological Society
Winona Welch, Dept. of Botany. Depauw University, Greencastle, Indiana

American Fern Society
Charles B. Heiser, Jr., Dept. of Botany, Indiana University

American Microscopical Society
David G. Frey, Dept. of Zoology, Indiana University

American Phytopathological Society
J. R. Shay, Dept. of Botany & Plant Pathology, Purdue University

American Society for Horticultural Science
Barbara Sholucha, Dept. of Botany, Indiana University

American Society of Ichthyologists and Herpetologists
Sherman A. Minton, Jr., Dept. of Microbiology, Indiana University Medical Center

American Society of Limnology and Oceanography
David G. Frey, Dept. of Zoology, Indiana University

American Society of Naturalists
Charles B. Heiser, Jr., Dept. of Botany, Indiana University

American Society of Parasitologists
Shelby D. Gerking, Dept. of Zoology, Indiana University

American Society of Plant Physiologists
Carlos O. Miller, Dept. of Botany, Indiana University

American Society of Plant Taxonomists
Charles B. Heiser, Jr., Dept. of Botany, Indiana University

American Society of Zoologists
Theodore W. Torrey, Dept. of Zoology, Indiana University

Biometric Society (ENAR)
Melvin W. Carter, Statistical Lab., Purdue University

Botanical Society of America
R. E. Cleland, Dept. of Botany, Indiana University

Ecological Society of America
Frank N. Young, Dept. of Zoology, Indiana University

Mycological Society of America
J. M. McGuire, Eli Lilly Research Laboratory, Indianapolis, Indiana

National Association of Biology Teachers
Philip Fordyce, Broad Ripple High School, Indianapolis, Indiana

Nature Conservancy
Lynton K. Caldwell, Thailand Public Administration Program, Dept. of Government, Indiana University

Phycological Society of America
Richard C. Starr, Dept. of Botany, Indiana University

Potato Association of America
H. T. Erickson, Dept. of Horticulture, Purdue University

Society for Industrial Microbiology
L. S. McClung, Dept. of Bacteriology, Indiana University

Society for the Study of Development and Growth
Robert Briggs, Dept. of Zoology, Indiana University

Society of Protozoologists
Ruth V. Dippell, Dept. of Zoology, and J. Stanley Rafalko, Dept. of Anatomy, Indiana University

Society of Systematic Zoology
David G. Frey, Dept. of Zoology, Indiana University

Tomato Genetics Cooperative
E. C. Stevenson, Horticulture Dept., Purdue University

THIS YEAR IT'S INDIANA

A.I.B.S. SPONSORED MEETINGS OF BIOLOGICAL SOCIETIES

INDIANA UNIVERSITY, BLOOMINGTON

August 24-28, 1958

INFORMATION ON HOUSING AND MEALS

RESIDENCE HALLS ACCOMMODATIONS will be available for single persons, couples, and families. Those staying three or four nights will be assigned on the American Plan. Those staying not more than two nights will be assigned on the European Plan, which will also be available for persons participating in the pre- and post-meeting activities.*

THE AMERICAN PLAN is a "package" plan of room and meals in an assigned dormitory. Rates are $6.00 per day, $18.00 minimum, for adults; $4.75 per day, $14.25 minimum, for children 7 through 17; $2.85 per day, $8.55 minimum, for children under 7. The American Plan covers the period from dinner on August 24 through luncheon on August 28. Rooms must be vacated by afternoon of August 28. Persons on this plan may occupy their rooms on the night of August 23 at the American Plan rate of $2.25. Persons staying for the night of August 28 or 29 will be moved to the European Plan housing center for these nights.

THE EUROPEAN PLAN is for rooms without meals and will be available for pre- and post-meeting activities and for a maximum of two nights during the regular meetings. Rates are $2.50 per person per night in a room with twin beds, $3.00 for a single room. Meals will be available in the Memorial Union as well as in local restaurants and hotels. Facilities are available for the storage of luggage without cost during the pre- and post-meeting periods.

OTHER HOUSING ACCOMMODATIONS will be available on the campus in the Campus Club (part of the Memorial Union), local hotels and motels, as well as other motels and the hotel and cabins in two state parks within a radius of twenty miles. Rates in the Campus Club are $4.50 for a single room, $5.50 for a room with a double bed, $7.50 for one with twin beds. All rooms are equipped with lavatories and are air-conditioned. Rates in the local hotels and motels compare favorably with those of similar quality in the Middle West generally. Campsites are available in the two state parks which are within twenty miles of the University.

RESERVATIONS for all housing, except campsites in state parks, should be returned as soon as possible on the attached form. *Do not send money with the pre-registration.* Those wishing to share a room with a particular person or to be assigned with a particular group should so indicate on the reservation form.

BANQUETS. The full price of banquets served on the campus will not exceed $3.00. Persons on the American Plan will be given a credit of 50 cents for breakfast or luncheon and 75 cents for dinner for on-campus banquets at the time the banquet tickets are purchased.*

ACKNOWLEDGEMENT of each advance registration *received before August 9* will be made on a form which should be presented on arrival when registration is completed.

* For further information refer to the AIBS Reports column, p. 43.

PRE-REGISTRATION IS ESSENTIAL TO PROPER ASSIGNMENT OF FACILITIES

REGISTRATION AND HOUSING APPLICATION

Name ..... (First) (Middle) (Surname)

Home Address..... (Street)

..... (City) (State)

Full names, sex, relationship of members, ages of children in my party:

.....

.....

.....

Professional Address .....

.....

Title.....

Institution.....

Society Membership:

(1).....

(2).....

(3).....

I plan to attend the following society banquets.....

.....

I plan to take the following field trips.....

.....

(Applies to Graduate Students only)

Signature of major professor.....

Male ☐ Female ☐ Graduate Student ☐

Expected time of arrival at Indiana University..... (Date & Hour)

By train at Bloomington ☐

By plane at Bloomington ☐

By plane at Indianapolis ☐
(Limousine service available to Bloomington)

By bus at Bloomington ☐

By car ☐

Departure from Bloomington..... (Date & Hour)

Please make reservations for me in a University Resident Hall ☐

I prefer housing in a
Hotel ☐ Campus Club ☐ Motel ☐

I will not require housing ☐

Remarks.....

.....

.....

Please print or type the above information and mail to:

EDUCATIONAL CONFERENCE BUREAU
INDIANA MEMORIAL UNION BLOOMINGTON, INDIANA

Date.....

Across the Editor's Desk

• **The Tissue Culture Association** is again sponsoring a course of instruction in the principles and techniques of cell and tissue culture. The 1958 course will be under the direction of John Paul, University of Glasgow, Scotland, and will be given at the University of Colorado School of Medicine, Denver, Colorado, from July 7 through August 1. Tuition will be $100.

This is an intensive four-week course dealing with the structure and function of living cells, techniques of tissue culture and interpretation of results. It is designed to give to responsible investigators a background of general information on cultured cells and an opening wedge of training in the application of the method to problems in several current areas of research.

Due to limitations of laboratory space, only fifteen active participants will be accepted. These places will be allocated in the main to those with no previous culture tissue experience who, in the committee's opinion, will derive benefit from the course. In addition, fifteen auditors will be accepted. Places as auditors will be allocated to senior applicants with predominantly administrative responsibilities and to those who have already had practical experience of tissue culture techniques. Evening lectures Monday through Friday by members of the staff and by distinguished guest lecturers will cover various fields of research in which tissue culture methods have been used to advantage. The evening lectures are open to members of the Faculty of the University of Colorado and to wives and families of participants in the course.

The course is designed specifically for post doctoral workers (M.D. or Ph.D.) who plan to use cultured tissues in their research or teaching. Requests for application forms should be addressed to Dr. Mary S. Parshley, College of Physicians and Surgeons, 630 West 168th Street, New York 32, N. Y., and should be completed and returned to her *not later than May 1*. Successful candidates will be notified about May 15.

• **A Symposium on Comparative Endocrinology** sponsored by Columbia University has been scheduled for May 26-29, 1958, at Cold Spring Harbor, N. Y. Because of housing limitations, it is urged that those interested in attending register in advance. For registration and information concerning the program write to: Symposium on Comparative Endocrinology, Department of Zoology, Columbia University, New York 27, New York.

• **The Gordon Research Conferences** for 1958 will be held from June 9-August 29 at Colby Junior College, New London, N. H.; New Hampton School, New Hampton, N. H., and Kimball Union Academy, Meridian, N. H. The Conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of scheduled lectures and free discussion groups. The purpose of the program is not to review the known fields of chemistry, but primarily to bring experts up to date about the latest developments, analyze the significance of these developments, and provoke suggestions as to underlying theories and profitable methods of approach for making new progress. No publications are prepared from Conference material. Individuals interested in attending a Conference are requested to send their applications to the Director. Each applicant must state the institution or company with which he is connected and the type of work in which he is most interested. Attendance at each Conference is limited to 100. The complete program of the Conferences were published in *Science* for February 28th. Requests for attendance at the Conferences, or for any additional information, should be addressed to W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, R. I. From June 9-August 29, 1958, mail should be addressed to Dr. Parks at Colby Junior College, New London, N. H.

• **The Eleventh Annual Summer Conference sponsored by the Biology Department of Brookhaven National Laboratory** is scheduled for June 16-18, 1958. The subject of the Symposium is "The Photochemical Apparatus—Its Structure and Function." Subsections to be discussed are: Physical Chemical Aspects, Biochemical Aspects, Morphological Aspects, Enzymatic Activities of Chloroplasts, and Enzymatic Properties of Primitive Photochemical Structures. Applications to attend this Symposium should be sent to Dr. R. C. Fuller, Brookhaven National Laboratory, Upton, L. I., N. Y., before May 23. Persons not citizens of the U.S.A. should indicate their nationality when applying. On-site accommodations for guests will be reserved in order of receipt of applications. Later applications for reservations will be filled insofar as they are available through one of the neighboring hotels or motels. Local conditions limit the number of accommodations to approximately 250.

• **An International Congress of Radiation Research** will be held at the University of Vermont, Burlington, Vermont, August 10-16, 1958, under the joint sponsorship of the National Academy of Sciences-National Research Council and the Radiation Research Society in cooperation with the European Committee on Radiobiology. The Congress is being organized to provide an international forum for an interdisciplinary attack on the broad area of radiation research. Under the chairmanship of the Congress President, Alexander Hollaender of Oak Ridge National Laboratory, the following symposia have been scheduled:

August 12—Role of Oxygen and Peroxides in Radiation Chemistry; Analysis and Correlation of Various Radiobiological Actions on the Same Cell Species (Yeast).
August 13—Free Radicals Produced by Irradiation.
August 14—Late Effects of Irradiation in Mammals.
August 15—Induced Changes in DNA and in Chromosome Structure.

In addition, plenary sessions have been planned on the progress and status of radiation research, and ample opportunity will be given those who wish to present contributed papers in the broad area of radiation research. Information concerning the presentation of papers, registration and housing may be obtained from Dr. Harvey M. Patt, Secretary General, International Congress of Radiation Research, Argonne National Laboratory, P. O. Box 299, Lemont, Ill.

• **A special summer laboratory course in The Techniques and Applications of the Electron Microscope** will be offered to qualified senior biologists and medical research workers, at Cornell University, June 16-July 3, 1958. The course will be under the direction of Benjamin M. Siegel. It will include extensive laboratory work, lectures covering the basic principles and methods, and lectures on specific biological applications to be given by prominent guest lecturers. The course is being sponsored by a grant from the National Science Foundation.

Since this laboratory course has been offered every year since 1950, this year's enrollment will be limited to senior workers in the medical and biological sciences. Among the guest lecturers will be Keith Porter, Rockefeller Institute; Cecil E. Hall, M.I.T.; Robley C. Williams, University of California; Paul Kaesberg, University of Wisconsin; and J. J. Kelsch, Radio Corporation of America. Applications should be submitted to Professor Benjamin M. Siegel, Rockefeller Hall, Cornell University, Ithaca, N. Y.

• **The National Science Foundation has awarded two major grants for research reactors.** A $300,000 grant goes to the State College of Washington, Pullman; and a $150,000 grant to the University of Virginia, Charlottesville. In each case the funds provided by NSF are being met equally by the university. Both universities will construct a swimming-pool type reactor, using enriched fuel elements and moderated by water. The following are some of the problems currently interesting the staff at State College of Washington: Genetic effects of nuclear radiations; uptake of iodine in cattle; absorption and translocation of isotopes in plants; effects of nuclear radiation on enzymes; isotope exchange reactions and complexion studies; neutron diffraction studies; and labeled insecticide studies on insects, plants and soils. Scientists at the University of Virginia intend to pursue research in:

mutations in seeds due to neutron irradiation: radiation effects on oxidation and corrosion inhibitors; metabolic action of the thyroid hormone; effect of neutron bombardment on the tensile strength of thin films; circular polarization of gamma rays: and neutron lifetimes in reactor structures.

• **The April 1958, issue of *Behavioral Science* contains the symposium "Concepts of Biology."** This symposium, reporting free discussion among distinguished biologists from different fields concerning theoretical aspects of current thinking in biology, included the following participants: Frank Brink, Jr., Ernest W. Caspari, David R. Goddard, Rollin D. Hotchkiss, Ernst Mayr, James G. Miller, Orr E. Reynolds, Francis O. Schmitt, George G. Simpson, James N. Spuhler, Paul A. Weiss, Sewall Wright, and R. W. Gerard (Chairman). *Behavioral Science* is a publication of the Mental Health Research Institute, University of Michigan, Ann Arbor. Price of the April issue alone is $1.75.

• **Colleagues and friends of the late Karl P. Schmidt have set up an endowment fund, to be known as the Karl P. Schmidt Fund, to assist naturalists in pursuing their studies.** Income will be dispersed as grants-in-aid to assist naturalists in the museum phase of their studies—the part that is often the most difficult to finance. Grants will be limited to visiting naturalists desiring to use the research facilities of the Chicago Natural History Museum. Applications may be for work in any area of natural history but not for assistance in financing field work. A self-perpetuating seven-man committee drawn from the staff of the Museum and the several universities in the Chicago area will administer the grants. The Museum will handle investment of the capital but will not be concerned with the administration of the Fund. The number and size of the grants will depend on the amount of capital endowment. A fund of $20,000 would provide between $800 and $1,000 a year. All interested donors should address their contributions to Karl P. Schmidt Fund, care of Chicago Natural History Museum, Roosevelt Road and Lake Shore Drive, Chicago 5, Ill. Checks should be made payable to the Karl P. Schmidt Fund.

• **In January of this year, a fire razed Padua Hall on the campus of St. Francis College, Loretto, Pennsylvania,** completely destroying the college library, numerous faculty offices, and the Biology Department. The Biology Department is asking for the help of biologists through either a gift or loan of slides, models, incubators, and other necessary biological equipment. Contributions and communications should be directed to Lawrence V. Pion, Acting Head, Biology Department, Saint Francis College, Loretto, Pa.

• **A National Federation of Science Abstracting and Indexing Services** was formed by representatives of the larger U.S. services at a three-day meeting in Philadelphia in January. The conference, which was organized by Biological Abstracts and supported by the National Science Foundation, was attended by thirty-four representatives of the following fourteen services: Applied Mechanics Review, Bibliography of Agriculture, Bibliography of Technical Reports (Office of Technical Services, Department of Commerce), Biological Abstracts, Chemical Abstracts, Current List of Medical Literature, Engineering Index, International Aeronautical Abstracts, Mathematical Reviews, Meteorological Abstracts, Nuclear Science Abstracts, Psychological Abstracts, Review of Metal Literature, Technical Abstract Bulletin (Armed Services Technical Information Agency). In addition, eleven representatives of the following organizations, which are concerned with the problems of abstracting and indexing, were present: American Association for the Advancement of Science, American Geological Institute, American Geophysical Union, National Science Foundation, UNESCO, U. S. Joint Publications Research Service. The new Federation will endeavor, through cooperative measures, education, and research, to improve the abstracting, indexing, and analysis of scientific information so that such information will be more readily available to all scientists and technologists in this country and throughout the English-speaking world. The stated objectives are: (1) encouraging the development of abstracting and indexing for those specialized fields not at present covered by such services and the further development of existing services; (2) seeking greater uniformity in such matters as journal citations and abbreviations, and transliteration of foreign language titles; (3) by cooperation, education, research, and the pursuit of mutually useful enterprises, to strive for the best possible research information services for science and technology in the U.S. and abroad. An interim executive committee of three was formed: G. Miles Conrad, Biological Abstracts, Chairman; Dale B. Baker, Chemical Abstracts; and John C. Green, Office of Technical Services, Department of Commerce. Funds for setting up a secretariat of the Federation will be contributed on a voluntary basis by services represented at the conference as an expression of their interest in the development of the new organization.

• **The University of Miami has announced the establishment of a doctoral program in the marine sciences.** Ph.D. degrees will be offered in the three fields of Marine Biology, Fisheries, and Oceanography, under the Department of Marine Sciences. Courses in ecology, physiology, biochemistry and taxonomy of marine animals, phycology, plankton and other specialized aspects of marine biology are being offered by a staff including H. B. Moore, Charles Lane, F. G. Walton Smith, Gilbert Voss, and Harding Owre. Fishery icthyology training is offered by C. P. Idyll, C. Richard Robins, John Randall, and Elwin S. Iversen. The oceanography courses, including geological, chemical, physical and meteorological aspects, are taught by Fritz Koczy, Cesare Emiliani, Eugene Corcoran, Homer Hiser, and Sigmund Miller. In addition to the Marine Sciences Department, the university will offer the doctorate in the Departments of Anatomy, Bacteriology, Biochemistry, Chemistry, Education, Pharmacology, Physiology, Psychology, and Zoology. The Graduate School of the University of Miami will accept applications for the doctoral program in Marine Sciences beginning in October, 1958, for entrance to the program in the fall of 1959. Inquiries should be addressed to Dr. C. P. Idyll, Chairman, Department of Marine Sciences, University of Miami, 1 Rickenbacker Causeway, Miami 49, Florida.

• **The Section of Animal Behavior and Sociobiology of the Ecological Society of America has concluded negotiations with the (British) Association for the Study of Animal Behaviour that will result in a new journal in the field of animal behavior.** The journal, to be called *Animal Behaviour*, will replace the present *British Journal of Animal Behaviour* and will initially publish some 260 pages per year. It will emphasize the interdisciplinary approach to animal behavior.

The present British Board of Editors will continue to serve the new journal, with the addition of the following American Editorial Board: Lester R. Aronson, American Museum of Natural History; Nicholas E. Collias, Illinois College; Alfred E. Emerson, University of Chicago; John T. Emlen, University of Wisconsin; E. B. Hale, Pennsylvania State University; Eckert H. Hess, University of Chicago; Daniel S. Lehrman, Rutgers University; J. P. Scott, Roscoe B. Jackson Memorial Laboratory; William S. Verplanck, Hunter College; and William C. Young, University of Kansas. David E. Davis, Johns Hopkins University, will serve as North American Associate Editor, and all American manuscripts should be submitted through him. Every effort will be made to maintain the high standards of the now replaced British Journal.

The first issue of *Animal Behaviour* went to press in March, 1958. Subscriptions are $3.00 for members of the Section of Animal Behavior and Sociobiology, and $5.00 for non-members ($2.00 for Section membership; $3.00 for the journal); North American subscriptions and Section memberships are available through the Section Secretary, Dr. Martin W. Schein, Department of Poultry Husbandry, Pennsylvania State University, University Park, Pennsylvania. Checks should be made payable to "Animal Behaviour." Institutional and Library subscriptions, at $8.00 per year, should be sent directly to the publishers, Bailliere, Tindall & Cox, Ltd., 7 & 8 Henrietta Street, London, W. C. 2, England.

• **The University of Wisconsin recently acquired the large private herbarium of the Rev. Frank C. Seymour,** Dighton, Massachusetts, containing over 20,000 specimens. The collection, originally started by the father of the former owner, mycologist A. B. Seymour, was bought by the University of Wisconsin with aid from the Wisconsin Alumni Research Foundation and the J. J. Davis Memorial Fund. It will be housed in the University Herbarium, recently expanded. Nearly half of the Seymour specimens were collected in Wisconsin and will be a great asset in the completion of many current herbarium projects.

• **Members of the Divisional Committee for Biological and Medical Sciences at the National Science Foundation are:** Frank Brink, Jr., Rockefeller Institute; Lincoln Constance, University of California; Frank A. Geldard, University of Virginia; C. N. H. Long, Yale University; William D. McElroy, Johns Hopkins University; C. Phillip Miller, University of Chicago; Clarence P. Oliver, University of Texas; Frank W. Putnam, University of Florida; H. B. Steinbach, University of Chicago; Kenneth V. Thimann, Harvard University.

• **The National Society for Medical Research has launched three new programs.** The first is a conference program aimed at bringing more consistency and logic to various state and local laws governing medical research. Out of these conferences it is hoped that a model code governing anatomical materials, human and animal experimentation, transplanting of organs and other medical scientific activities may develop. A second program has the purpose of improving the design of laboratory animal quarters. An NSMR staff architect will accumulate experience date and provide expert consultation. The third of the Society's new activities is a program to educate the public on the importance of student experiments with animals. Officers elected at the annual meeting of the Society are: President: Lester R. Dragstedt; Vice-President: Alfred Blalock; Secretary-Treasurer: Louis N. Katz; Executive-Secretary: Ralph A. Rohweder.

• **Two new National Science Foundation reports have been released: (1)** ***Review of Data on Research and Development, No. 9, Scientists and Engineers in Research and Development, 1954.*** The report shows that there were 230,000 scientists and engineers engaged in research and development activities in the natural sciences in 1954—68,000 physical scientists, 139,000 engineers and 22,000 life scientists. Over half of the research and development life scientists were employed by colleges and universities; only 19 percent by industry, and 22 percent by the Federal Government. **(2)** ***Immigration of Professional Workers to the United States, 1953-1956.*** This survey revealed the fact that almost 60,000 immigrants classified as professional, technical, and kindred workers entered the U.S. for permanent residence during 1953-1956. Engineers constituted the largest occupational segment of the 60,000 immigrants. Nurses were second, and teachers of all kinds below college level, third. Physicians and surgeons were fourth, and natural scientists, fifth. Over 40 percent of the professional group came directly from Europe in these four years, with the United Kingdom and Germany providing the largest numbers. Canada, however, outnumbered any European country as a source of immigrants in this group. New York, California, and Illinois were the most popular choice of this group as destinations.

Requests for copies of either of these reports should be addressed to the National Science Foundation, Washington 25, D. C.

• **Pomona College, Claremont, California, recently awarded a $1,300,000 contract for construction of a biology-geology building on the campus.** This will be the second science building to be erected by the college this year. A physics-mathematics-astronomy building costing $1,100,000 is under construction and scheduled for completion this summer. Both buildings, costing a total of more than $2,500,000, including equipment, furnishings and fees, have been made possible by an anonymous donor.

• **Research grants totaling $7,634,327 were awarded during the month of December, 1957, by the National Institutes of Health, Bethesda, Maryland.** Non-Federal scientists and institutions throughout the Nation received a total of 545 grants to support research in medical and related fields. The grants were distributed to 223 institutions.

• **The Atomic Energy Commission has approved grants totaling $373,559 to thirty American colleges and universities for assistance in equipping their laboratories for training in nuclear technology as applied to the life sciences.** These grants will be used by colleges and universities to expand facilities for training in radiation biology and the use of radioisotopes in the fields of agriculture, veterinary medicine, medicine and pharmacy, public health, and departments of biology. The next review of requests for such assistance will be made in the spring of this year. Educational institutions interested in this program may obtain further information from the Director, Division of Biology and Medicine, U. S. Atomic Energy Commission, Washington 25, D. C.

• **The National Science Foundation has announced 409 grants totaling $15,035,656** awarded during the quarter ending December 31, 1957, for the support of basic research in the sciences, for the support of basic research facilities, for conferences in support of science, for exchange of scientific information, and for training of science teachers.

• **Effective immediately, the names of two Library of Congress monthly publications, which serve as keys to new literature coming into this country from the U. S. S. R. and East Europe, will be changed from "Lists" to "Indexes."** The purposes of the change is to indicate to scientists and other scholars not familiar with the monthlies that they are more than mere booklists. The "Monthly List of Russian Accessions," which enters its eleventh year of publication in April, 1958, becomes the "Monthly Index of Russian Accessions." The Government Printing Office sells it for $12 a year ($15 abroad).

The "East European Accessions List," published since 1951, becomes the "East European Accessions Index." The GPO sells it for $10 a year ($12.50 abroad). Each index gives in English a monthly account of new materials in a variety of subject fields as received from the U. S. S. R. and East Europe by the Library of Congress and by other American research libraries. The translation of all titles of books and articles into English and the elaborate subject guides permit a researcher who has no command of Russian or East European languages to easily identify the material he needs. Fifty-four percent of a recent volume of the "Monthly Index of Russian Accessions" was in the field of science and technology.

• **A translation of a published report on Russia's five-year plan for research in pharmacology is available from the National Institutes of Health, U. S. Public Health Service.** The report cites successes attained in pharmacologic research during the period 1950-55 and discusses expectations for the period 1956-1960. The original report, unsigned, appeared in the July-August, 1956, issue of *Farmakologiia i Toksikologiia* (Volume 19, Number 4, pages 57-62). Copies of the translation, entitled, "Problems Involved in Five-Year Plan for Research in Pharmacology for 1956-1960," are available from the Publications and Reports Section of the Scientific Reports Branch, National Institutes of Health, Public Health Service, Bethesda 14, Maryland.

• **Consultants Bureau, Inc., New York, has obtained exclusive world-wide rights to translate and publish complete English language editions of twenty Soviet scientific and technical journals.** The agreement was reached with Mezhdunarodnaya Kniga, Soviet publications export agency. Included in the agreement were Soviet publications in physics, chemistry, electronics, metallurgy, biology and medicine. Most of the journals covered are already being translated by Consultants Bureau on a yearly subscription basis. The new agreement will make it possible for the publisher to shorten the time interval

between the date of publication and the translated edition. Copies of photographs appearing in the journals are also to be provided, so that the quality of reproduction will be improved. In addition to cooperation in the express-translation-publication project, the Soviet agency has agreed to inform Consultants Bureau in advance about changes in size or frequency of journals, projected supplements and special issues. Consultants Bureau will also receive advance information about new Soviet publications which will be passed on to the English-speaking scientific world. Consultants Bureau has committed itself to publication of the following journals in translation for 1958: Biochemistry; Bulletin of Experimental Biology and Medicine; Proceedings of the Academy of Sciences, USSR; Journal of General Chemistry; Journal of Analytical Chemistry; Journal of Applied Chemistry; Chemistry Section of the Bulletin of the Academy of Sciences, USSR; Automation and Remote Control; Colloid Journal; Metallurgist; Microbiology; Plant Physiology; Journal of Technical Physics; Journal of Acoustics; Pharmacology and Toxicology; Crystallography; Theory of Probability and Its Applications; Astronomical Journal; Optics and Spectroscopy; Experimental Instruments and Techniques.

• **The World Health Organization (WHO), with headquarters in Geneva, Switzerland, will celebrate its tenth anniversary this year** at a special session of its governing body, the World Health Assembly, to be held at Minneapolis beginning May 26th. Eighty-eight countries are now members of WHO, which works with national health services to prevent infectious disease and to train health workers. WHO gives technical assistance to improve sanitary conditions in over one hundred countries, warns about outbreaks of epidemic disease, coordinates research and recommends international standards for drugs and vaccines.

• **The International Conference on Scientific Information,** to be held in Washington, D. C., November 16-21, 1958, at the Mayflower Hotel, is expected to have approximately 150 active participants, either as authors of selected papers or as designated members of discussion panels. It is also expected that approximately 500 persons will attend the Conference as observers. Registered observers may attend all discussion sessions, although active participation in these will be limited to members of the panels and authors of papers. Observers, however, will have the privilege of submitting relevant questions and comments in writing to the panels prior to the opening of the Conference. Advance registration of observers will be necessary and will include payment of a fee of $10.00 per person.

• **The History of Science Society has again announced the annual award of the $250 Henry and Ida Schuman prize in the history of science.** This competition is open to undergraduate and graduate students in any American or Canadian college, university, or institute of technology. Papers submitted for the prize competition should be approximately 5,000 words in length, exclusive of footnotes, and thoroughly documented. The subject "History of Science and Its Cultural Influences" should be broadly interpreted. Essays dealing with medical subjects are not acceptable, although papers dealing with the relations between medicine and the natural sciences will be welcomed. It is hoped that the prize-winning essay will be suitable for publication in *Isis*, the journal of the History of Science Society. Papers submitted for the competition should be sent to the Chairman of the Prize Committee, Professor Raymond P. Stearns, 313 Lincoln Hall, University of Illinois, Urbana, Ill. Inquiries should also be addressed to Professor Stearns. To be eligible for consideration, papers must be received on or before July 1, 1958. The announcement of the prize-winning essay will be made at the annual meeting of the History of Science Society in December, 1958.

• **Nominations for the Sixth Kimble Methodology Research Award are being accepted until June 1, 1958.** This award, which gives recognition to the application of scientific knowledge to the Public Health Laboratory, was established by the Kimble Glass Company of Toledo, Ohio and is sponsored by the Conference of State and Provincial Public Health Laboratory Directors. The cash award of $1000 and silver plaque will be presented at the annual meeting of the Conference to be held at St. Louis, Missouri, in November, 1958. Rules governing nominations can be obtained from Neil Hollinger, Chairman, Nominating Committee, Kimble Award, School of Public Health, University of California, Berkeley 4, Calif.

• **The Pacific Marine Station, of the College of the Pacific, has announced a resident pre-doctoral fellowship in marine biology,** primarily for the support of research in connection with the applicant's thesis program. The stipend is $1,800 per year, including living quarters and remission of fees if enrollment in course work is desired. The fellowship may be awarded for one semester or a full year; applicants should provide a supporting letter from their major professor. During the spring semester (February 3-June 6) a course in invertebrate zoology will be offered at the station. During the summer session (June 23-August 6 or 8) courses in marine invertebrate biology and paleontology will be offered. Emphasis in the invertebrate course will be on the rich local fauna and its ecology; the course is designed for advanced undergraduates, graduates and secondary school teachers, and meets the requirements of many institutions for a summer at a marine station as part of the Ph.D. curriculum. The paleontology course will emphasize evolution and paleoecological problems. The summer faculty will include the director, Alden E. Noble, College of the Pacific, Ralph G. Johnson, University of Chicago and guest lecturers. Address all correspondence to Joel W. Hedgpeth, Director, Pacific Marine Station, Dillon Beach, Marin County, California.

• **The Organization of American States has established a new fellowship program which will enter into force, July 1, 1958, and will offer grants for advanced study or research to specialists throughout the Western Hemisphere.** Qualified persons who are looking for an opportunity to do pure research, improve their professional skill through a postgraduate course, or enroll in an advanced technical course may apply now to the program. By offering advanced study abroad, the OAS hopes to increase the individual's contribution to his country of residence. Interested persons should address their inquiries and requests for necessary forms to: Technical Secretary, OAS Fellowship Program, Pan American Union, Washington 6, D. C.

• **The General Biological Supply House, Chicago, has announced the Turtox Scholarship in Biology.** Stipend for the scholarship is $5,000. Eligible for consideration is any American citizen who is currently, or has been, enrolled in a Graduate School and who is, or is contemplating, continuing study for the doctorate degree in Botany, Zoology, or Biology. The award will be based upon evidence bearing upon the promise of the applicant as a prospective teacher and research scholar. Application blanks may be requested from the Chairman of the Award Committee, Dr. Frank A. Brown, Jr., Department of Biological Sciences, Northwestern University, Evanston, Ill.

• **Graduate research fellowships at the Carver Foundation, Tuskegee Institute, Alabama, are now offered** for research in graduate studies toward the Master of Science degree in chemistry, foods and nutrition and agronomy. They are available to students with high scholastic records, who have received the B.S. degree from an accredited college and who show promise of research ability. Stipends range from $1,200 to $1,800 annually. Fellowship applications are immediately acceptable. Further requests for information should be addressed to: The Director, The Carver Foundation, Box 188, Tuskegee Institute, Alabama.

• **U. S. Government awards under the Fulbright and Smith-Mundt Acts are now available for 1959-60 in university lecturing and advanced research.** Applicants must be U. S. citizens; for lecturing, at least one year of college or university teaching experience is necessary; for research, a doctoral degree or recognized professional standing is needed. In some cases, a knowledge of the language of the host country is required. The awards are

tenable in one country, usually for an academic year, and payable in currency of the host country. Roundtrip travel is included for the grantee but not for members of his family. A maintenance allowance to cover ordinary living expenses of the grantee and family while in residence abroad is part of the award. A small incidental allowance for travel, books and services required in performance of assignments is also available. The 1959-60 awards are available in Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Australia, New Zealand, Burma, India, Pakistan, Philippines, Thailand. Closing date of application is April 25, 1958. Application forms and additional information may be obtained from: Conference Board of Associated Research Councils, Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C.

• ***Daedalus*, a new publication of the American Academy of Arts and Sciences,** Boston, Mass., has appeared. Philip Rieff is Editor. The first issue carries articles on "Science and the Modern World View" by contributors: Gerald Holton, Henry Guerlac, Harcourt Brown, Giorgio de Santillana, Phillipp Frank, Robert Oppenheimer, Jerome S. Bruner, P. W. Bridgman, Charles Morris and Howard M. Jones. The journal, a quarterly, has a yearly subscription price of $6.50. Inquiries and orders should be addressed to American Academy of Arts and Sciences, 280 Newton St., Brookline Station, Boston 46, Mass.

• **The first number of another new journal, *Perspectives in Biology and Medicine*, has appeared.** This is a publication of the University of Chicago Press, under the sponsorship of the Division of Biological Sciences, University of Chicago. Editors are D. J. Ingle and S. O. Waife. The first issue contains articles by: Herman M. Kalckar, C. Judson Herrick, M. S. Goldstein and E. R. Ramey, Russell Meyers, M. E. Krahl, Roger J. Williams, Lawrence S. Kubie, and George Day. Subscription rates: $6.00 per year (University of Chicago Press, 5750 Ellis Ave., Chicago 37, Ill.). Editorial correspondence should be addressed to: Dr. Dwight J. Ingle, Ben May Laboratory for Cancer Research, University of Chicago, 950 East 59 St., Chicago 37, Ill.

• **Wayne State University Press will publish, April 1, a group of papers read before a 1957 joint annual meeting of the American Society of Human Genetics and the American Society of Physical Anthropologists.** The title is *Natural Selection in Man*, arranged by J. N. Spuhler (72 pgs., clothbound, $3.50). Authors include: James W. Crow, Philip Levine, Carleton S. Coon, and James V. Neel.

• **The Department of Biology of Adelphi College, Garden City, N. Y., has initiated a Master of Science in Biology Program, starting September 1958.** The program is unique in that it will make use of the facilities of specialized research laboratories in the area for the training of graduate students during the period of their thesis research. Irwin Fand, Director of the discipline and Laboratory for Cytophysiology at the Institute for Biological Studies at Creedmoor Hospital will coordinate this phase of the program. This cooperative endeavor of a State supported research laboratory and a liberal arts college offers unique opportunities to the students enrolled. Katherine Brehme-Warren, who is currently working under a NSF grant on a revision of the Bridges and Brehme monograph of "The Mutants of Drosophila melanogaster," will join the Adelphi College Graduate faculty in September 1958. Dr. Warren will be responsible for coordinating the research of graduate students in genetics, who, under a cooperative arrangement with the Long Island Biological Laboratory and the Carnegie Institution of Washington at Cold Spring Harbor, will conduct their research in these laboratories.

• **The National Science Foundation has announced the award of 54 Science Faculty Fellowships for the academic year 1958-59 and 27 Senior Postdoctoral Fellowships for 1958-59.** Both types of Fellowships carry stipends adjusted to approximate the regular salaries of award recipients.

• **The Gustavus and Louise Pfeiffer Research Foundation recently made a grant to the Department of Biological Sciences at the University of Indonesia at Jakarta.** The money will be used to encourage Indonesian students to continue research in various fields of biology and for special equipment and supplies that may be needed but are not available in Indonesia. The research program of the University of Indonesia is significant because heretofore almost no zoological research has been done in the country. Visiting chairman of the Biological Sciences Department, Gilbert Church, was sent to Indonesia as part of the University of California's School of Medicine's Indonesia Project in Medical Education.

• **The University of Illinois has acquired letters, photographs, experiment notes and personal papers of Gregor Mendel, founder of the science of genetics.** It is believed that this material is the only remaining Mendeliana. The material was purchased from the widow of Hugo Iltis, biographer of Mendel, who assembled an extensive collection at Brunn, Czechoslovakia, before fleeing from the Nazis in 1939. The part of the collection left behind in Czechoslovakia is now believed to have been lost or destroyed.

• **The recent appointment of Wallace R. Brode as Science Advisor, Department of State, a long vacant post, received the following comments** in a February 3 Department of State Bulletin: "Dr. Brode's appointment signals a fresh emphasis on a postwar Department of State function curtailed in 1955 in order that the program might be reviewed and plans made for the future. Reexamination during the past year indicated the growing importance of activities of scientists as a significant element in formulating foreign policy and in carrying on relations with other governments. The new work will therefore be oriented more closely than before to the objectives of the Department and the Foreign Service. Both the Science Adviser and the science attachés will be responsive to requirements of other government departments that carry on scientific activities abroad, since certain of these activities form parts of the pattern of our foreign relations. Dr. Brode will also keep in close touch with Dr. Killian."

"As counterparts overseas of the Science Adviser in Washington, certain science attachés will be appointed to advise and collaborate with political, economic, and other embassy officers on those foreign-relations questions in which scientific considerations play a part. They will also assist other Federal agencies and private groups in carrying out their programs of scientific cooperation abroad, such as those of the National Science Foundation, the International Cooperation Administration, the National Academy of Sciences, etc. Like other members of the Foreign Service, they will keep the Department currently informed of developments significant for international relations."

• **The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the life sciences is May 15, 1958.** Proposals received prior to that date will be reviewed in the Summer meetings of the Foundation's Advisory Panels and disposition will be made approximately four months following the closing date. Proposals received after the May 15, 1958 closing date will be reviewed following the Fall closing date of September 15, 1958.

• **The German Council of Arts and Sciences (Wissenschaftsart) was officially established in February at Bonn University.** According to an agreement made between the Federal Government and the States, this Council is to coordinate all Western German plans for the advancement of the arts and sciences, to draw up a program of matters to be given attention, and to submit recommendations on how available funds are to be used.

• **The National Science Foundation has announced the award of 756 Predoctoral Graduate Fellowships** in the natural sciences and allied fields for the academic year 1958-1959. Successful Fellows were selected from 3,804 applicants from all parts of continental U.S.A., Ha-

waii, and Puerto Rico. In addition to the Predoctoral Fellowships awarded, the Foundation has also announced the names of **85 winners of regular Postdoctoral Fellowships.** The largest number of Predoctoral Fellowships, 178, were awarded in physics. In other fields, the numbers of awards were: chemistry, 158; engineering sciences, 93; mathematical sciences, 92; zoology, 54; earth sciences, 45; biochemistry, 29; psychology, 21; medical sciences, 12; botany, 12; genetics, 12; anthropology, 9; microbiology, 8; biophysics, 8; agriculture, 5; astronomy, 5; general biology, 5. In addition, 10 awards were made in areas where the natural sciences converge with the social sciences.

Of the regular Postdoctoral Awards, 32 were made in the life sciences, 18 in chemistry, 18 in physics and astronomy, 11 in the mathematical sciences, 2 in the earth sciences, 1 in the engineering sciences and 3 in converging areas.

• **The United States is participating with fourteen other countries in the International Science Hall at the Brussels World's Fair, 1958,** by making contributions to a series of scientific exhibits related to the peaceful uses of nuclear energy and to the historic advances made in chemistry. The American contribution is in four distinct categories concerned with the atom, the molecule, the living cell and the crystal. All of the American display elements are being coordinated by the National Science Foundation which also is responsible for their administration and funding. The General Chairman of the NSF exhibits is Paul A. Weiss. Under the Living Cell Class, six areas were singled out for major exhibits: (1) *Cell Structure in Relation to Biochemical Function*, organized by Albert L. Lehninger, Johns Hopkins University; (2) *Photosynthesis*, organized by Melvin Calvin, University of California; (3) *Cell Nutrition*, organized by Louis G. Nickell, Charles Pfizer & Company; (4) *Genetics of Simple Organism*, organized by Francis H. Ryan, Columbia University; (5) *The Biology of Viruses*, organized by James W. Moulder, University of Chicago; and (6) *Intercellular Parasitism*, organized by Clay G. Huff, Naval Medical Research Institute.

• Following a meeting sponsored by the Office of Naval Research and organized by the AIBS Advisory Committee on Hydrobiology in Puerto Rico in 1957, **an Association of Island Marine Laboratories was formed.** In February, this group issued its first *Information Bulletin*. Laboratories in the Association are: Bermuda Biological Station; The Lerner Marine Laboratory, American Museum of Natural History; Institute of Marine Biology, University of Puerto Rico; The Bellairs Research Institute, McGill University; The Caribbean Marine Biological Station, Curacao; University College of the West Indies, Marine Laboratory, St. Andrews, Jamaica; Laboratorio de Biologia Marina, Universidad de Oriente; Laboratorio de Biologia Marina, Universidad Catolica de Villaneuva, Cuba; Instituto Nacional de Pesca, Havana, Cuba; Oceanographic Institute, University of Havana, Cuba; Fisheries Research Laboratory, Marine de Guerra (Centro de Investigaciones Pesqueras), Playa Habana, Baracoa, Cuba; Hydrographic Office, Cuban Navy, Habana, Cuba.

• **The Board of the Canadian Federation of Biological Societies was formed October, 1957, in Ottawa.** The Federation is comprised of four societies: the Canadian Physiological Society, the Pharmacalogical Society of Canada, the Canadian Association of Anatomists, and the Canadian Biochemical Society. The Federation will hold its first annual meeting in June, 1958, at Kingston, Ontario. Further information may be obtained from Dr. E. H. Bensley, Montreal General Hospital, Montreal 25, Quebec.

• **The Department of Biological Sciences of Purdue University will move into its new Life Science Building in September, 1958.** This building, costing over $12,000,000, includes approximately 5½ acres of laboratory, teaching and research space. The Department, which is directed by John S. Karling, closely integrates the various fields of biology and includes the Divisions of Bacteriology, Biophysics, General Biology, Plant Sciences and Zoology with a staff of 33 professors, 10 instructors and 55 assistants and technicians.

• **Ernest C. Faust,** William Vincent Professor of Tropical Diseases and Hygiene, Tulane University, received in November, 1957, the Bernard Noct Medaille of the Hamburg Institut für Schiffs-und-Tropenkrankheiten. Dr. Faust is also visiting professor on the Medical Faculty of Valle, Cali, Colombia where he is serving as field coordinator in the Tulane-Colombia medical education, sponsored by the U. S. International Cooperation Administration and the Colombian Government.

• **Alan T. Waterman,** Director of the National Science Foundation, has been appointed Chairman of the Interdepartmental Committee on Scientific Research and Development. This committee was formed to coordinate the scientific activities of a number of government agencies including those of the Atomic Energy Commission, the Department of Defense, and the National Science Foundation.

• **Clay G. Huff,** Head of the Division of Parasitology, Naval Medical Research Institute, Bethesda, Maryland, has received the Navy Distinguished Civilian Service Award "for exceptional and exemplary contributions which have added significantly to the prestige of Naval medical research in the field of parasitology."

• **George G. Simpson,** Chairman of the Department of Geology and Paleontology at the American Museum of Natural History, has asked to be relieved of his administrative duties that he might devote more time to research, teaching and his position as curator of mammals, fossils and birds. Dr. Simpson's activities have been somewhat curtailed since a serious accident suffered in Brazil in 1956. **Edwin H. Colbert,** Curator of Fossil Reptiles and Amphibians, has been appointed Chairman.

• **Charles K. Weichert,** Chairman of the Department of Biological Sciences, University of Cincinnati, has been appointed Dean of the University's McNicken College of Arts and Sciences.

• **Robert H. Gibbs, Jr.,** has joined Boston University as assistant professor of biology. Dr. Gibbs was formerly a research associate in marine biology at the Woods Hole Oceanographic Institution.

• **Arthur W. Martin,** Professor and Executive Officer, Department of Zoology, University of Washington, has been named Program Director for Regulatory Biology in the Division of Biological and Medical Sciences, National Science Foundation, effective February, 1958.

• **Samuel L. Meyer,** Dean, Central College, Fayette, Missouri, and former Executive Director of AIBS, has accepted an appointment as Academic Vice-President of the College of the Pacific, Stockton, Calif.

• **Paul M. Fye** has been named Director of the Woods Hole Oceanographic Institution. Dr. Fye was formerly Associate Technical Director for Research at the Naval Ordnance Laboratory, Silver Spring, Maryland, and Special Advisor for the Polaris Missile Program.

Columbus O'D. Iselin, Director of the Institution from 1940 to 1950 and since 1956, has been elected to be the first Henry Bryant Bigelow Oceanographer, a Chair founded recently by the Board of Trustees.

• **Laurence H. Snyder,** Dean of the Graduate College, University of Oklahoma, will become President of the University of Hawaii, July 1, 1958. Dr. Snyder is retiring president of the AAAS and Chairman of its Board of Directors.

• **Hubert A. Lechevalier,** Associate Professor of Microbiology, Rutger's Institute of Microbiology and co-discoverer of neomycin, will leave shortly for Moscow under the new Cultural and Technical Agreement between the United States and the U.S.S.R. In exchange, the Soviet Union has sent to Rutgers, **G. K. Scriabin,** a member of the Microbiological Research Team directed by N. A. Krassilnokov of the Soviet Academy of Sciences.

• **James H. Bywater,** Professor of Poultry Husbandry at Virginia Polytechnic Institute, has been named Director of

Research at the William H. Miner Agricultural Research Institute, Chazey, New York.

• **Gottfried S. Fraenkel,** Department of Entomology, University of Illinois, is now in Japan (until September) on sabbatical leave to work with Toshio Ito on the necessity of mulberries to silk worm production.

• **Robert M. Jenkins,** Director of the Oklahoma Fisheries Research Laboratory, has accepted an appointment to the position of Assistant Executive Vice-President of the Sport Fishing Institute, Washington, D. C.

• **Conrad A. Elvehjem,** Dean of the University of Wisconsin's Graduate School since 1946, has been elected the thirteenth president of the University.

• **Bertrand Russell,** British philosopher, writer and mathematician, has received the 1957 Kalinga Prize for the popularization of science. This prize is offered annually by UNESCO in recognition of the work of leading interpreters of science and of strengthening links between India and scientists of all nations. Nominations for the Kalinga Prize are received each year from various scientific groups directly interested and particularly from national associations for the advancement of science and national associations of science writers. Bertrand Russell was nominated by the Venezuelan Association for the Advancement of Science.

• **W. P. Thompson,** President of the University of Saskatchewan, has been named President of the IXth International Botanical Congress to be held in Montreal, Canada, August 19-29, 1959. Dr. Thompson, an international authority on the genetics of cereals, has been President of the Royal Society of Canada and President of the National Conference of Canadian Universities.

• **Thomas D. Fontaine** has been appointed Program Director for Fellowships, Division of Scientific Personnel and Education of the National Science Foundation. Dr. Fontaine, previously a research chemist for the Department of Agriculture, served for the past two and a half years as Administrative Assistant to Senator John C. Stennis of Mississippi.

• **Carl C. Lindegren,** Director of Southern Illinois University's Biological Research Laboratory, was honored by the Society of Illinois Bacteriologists at the eleventh annual Pasteur Award dinner in February.

• **George P. Fulton, Jr.,** Chairman of the Department of Biology, Boston University, is currently visiting professor of physiology at the Stanford University School of Medicine in San Francisco.

• **George W. Beadle** has been appointed Eastman Visiting Professor at the University of Oxford, England, for the academic year, 1958-1959. Dr. Beadle is professor of biology and Chairman of the Biology Division at California Institute of Technology.

• **Bentley Glass,** Department of Biology, Johns Hopkins University, has been elected President of the Board of Trustees of *Biological Abstracts.*

• **B. D. Thomas** has been elected President of the Board of Trustees of Battelle Memorial Institute, Columbus, Ohio.

• **James B. Kitzmiller** has been appointed Chairman of the Department of Zoology at the University of Illinois. The Department recently adopted the chairman-executive-committee form of administration in place of the headship. **F. B. Adamstone,** who has been head, will continue as Professor of Zoology.

• **David R. Lincicome,** professor of parasitology, Department of Zoology, Howard University, Washington, D. C., has been elected a Fellow of the New York Academy of Sciences. Dr. Lincicome is also guest scientist at the Naval Medical Research Institute, Bethesda, and editor of the journal, *Experimental Parasitology.*

• **Benjamin G. Chitwood,** Chief Nematologist of the State Plant Board of Florida, has accepted a position with the Kaiser Foundation at Berkeley, California, effective February 1, 1958.

• **L. R. Hesler,** Dean of the College of Liberal Arts and Professor of Botany since 1919 at the University of Tennessee, will retire at the end of the current year. Dr. Hesler plans to continue research on southeastern agarics.

• **Rodger D. Mitchell** has been appointed assistant professor of biology at the University of Florida. Dr. Mitchell has been on the University of Vermont staff for the past two years.

• **James D. Watson,** Harvard University, was a George A. Miller Visiting Professor in the Department of Bacteriology at the University of Illinois during February and March. He gave a series of lectures on macromolecular replication and cell growth.

• **Ralph W. Lewis,** Professor of Natural Science at Michigan State University, will conduct a year of research in the laboratory of E. D. Chain at the Instituto Superiore di Sanita in Rome, Italy.

• **Detlev W. Bronk,** President of the Academy of Science and of the Rockefeller Institute for Medical Research, was the recipient of the Gold Medal of the International Benjamin Franklin Society.

• The illustration which appears below on this page is a photograph of an Virginia Polytechnic Institute in January. Dr. Wilson, who has been at V.P.I. since 1923, has accepted a two-year contract with the International Cooperation Administration to be a consultant to Indian universities.

• **Richard S. Adams** has been appointed Cattle and Sheep Research Specialist at the General Mills Larrow Research Farm, Indianola, Iowa. Dr. Adams has been assistant professor of dairy science at Pennsylvania State University.

• The illustration which appears below on this page is a photograph of an oil caricature of **Paul J. Kramer,** Duke University. The painting was presented to Dr. Kramer in February. According to the artist, John P. Decker, "the spigot and cylinder symbolize Dr. Kramer's major professional interest—water relations of trees. Because of his disinterest in statistics, he is shown recording data on the ancient abacus. The chapel is the Duke landmark. The foliage overhead symbolizes his interest in pines, hardwoods and ornamentals. The cardinal is a double symbol: the North Carolina state bird, and his interest in the Boy Bird Watchers Society. Saturn is a pun on his current interest in Outer Space in Plants (Science *125*: 633, 1957). The device in the left foreground indicates that there are still some intriguing mysteries about how water is taken up by trees."

• **Charles L. Dunham,** Director of the Division of Biology and Medicine, and **Samuel R. Sapirie,** Manager of the Operations Office, Oak Ridge, Tennessee, recently received the U. S. Atomic Energy Commission's Distinguished Service Awards, the highest honor that the Commission can bestow.

• **Harold J. Lutz,** Morris K. Jessup Professor of Silviculture and Director of Forest Research in Biology, Yale University, is the recipient of the Society of American Foresters Award for Biological Research. The award was given in recognition of Dr. Lutz's lifetime work and particularly for his studies conducted in Alaska on the effect of forest fires on vegetation.

• **S. H. Wittwer** and **F. G. Teubner,** Michigan State University horticulturalists, received the first AAAS-Campbell Award for Vegetable Research during the recent AAAS Indianapolis meetings. The award which consists of $1,500 and a bronze medal was established in 1957 by the Campbell Soup Company. The award was granted for joint work on flower formation and fruiting in the tomato.

• **Charles B. Metz,** Professor of the Oceanographic Institute of Florida State University, has been named Associate Director of the Institute, effective Spring, 1958.

Recent deaths among biologists:

Carleton R. Ball, Washington, D. C.; formerly principal agronomist of the USDA. 84; Feb. 1958.

George Smith Bryan, Madison, Wis.; professor emeritus of botany at University of Wisconsin. March, 1958.

Guy G. Campbell, Chicago, Ill.; specialist in tropical medicine and former physician to Emperor Haile Selassie of Ethiopia. 67; Dec. 1957.

John G. B. Castor, San Francisco, Calif.; associate professor of enology and associate microbiologist in the Experiment Station of the College of Agriculture, Davis. 49; Jan. 1958.

Lloyd Emmons, East Lansing, Mich.; dean emeritus of Michigan State University's School of Science and Arts and assistant director of the Michigan State Museum. 72; Dec. 1957.

W. R. Graham, Toronto, Canada; professor at Ontario Agricultural College for 41 years, one of the founders of the Poultry Science Association, from which the World Poultry Science Association grew. 82; Jan. 1958.

Velma D. Matthews, High Point, N. C.; head of the biology department of Coker College, Hartsville, S. C., since 1935. 53; Jan. 1958.

W. A. Murrill, Gainesville, Fla.; retired staff member of the New York Botanical Garden and former editor of *Mycologia.* 88; Dec. 1957.

Louis H. Powell, St. Paul, Minn.; director of the Science Museum, St. Paul, since 1931. Nov. 1957.

Edward G. Reinhard, Washington, D. C.; professor and head of the biology department, Catholic University of America. 58; Jan. 1958.

Fletcher Reynolds, Cleveland, Ohio; director of the Cleveland Zoo, past president of the American Association of Zoological Parks and Aquariums. 55; Dec. 1957.

Sam F. Trelease, New York, N. Y.; Torrey professor of botany at Columbia University. 65; Jan. 1958.

Abby H. Turner, South Hadley, Mass.; professor emeritus of physiology at Mount Holyoke College and founder of the department of physiology. 82; Nov. 1957.

Frederick A. Waterman, Tucson, Ariz.; assistant professor of zoology, University of Arizona, formerly associate professor of biology, Wayne University. 53; Dec. 1958.

Thomas L. York, Ithaca, N. Y.; associate professor of vegetable crops and plant breeding, Cornell University. 36; Dec. 1957.

From the Societies

• **The American Phytopathological Society is celebrating its fiftieth anniversary during 1958.** In connection with this Golden Jubilee Anniversary a series of outstanding symposia by internationally-known authorities is being presented at the meeting of the Society with the A.I.B.S. in Bloomington, Indiana, August 24-28. Symposium topics cover a wide range of fields of basic interest to many biologists, and include significant achievements in the following: Fungicidal action, physiology of parasitism, structure and multiplication of viruses, pathogenicity and disease resistance, soil microbiology, biology of root disease fungi, nematology, disease epidemiology, and historical and developmental aspects of plant pathology.

A volume of approximately 1000 pages containing all fifty papers appearing on the program of symposia, as well as contributions by the chairmen of symposia and discussion leaders, will be published by the A.P.S. Bound in regular book binding, it will be titled: "Plant Pathology—Problems and Progress 1908-1958." The price of the Golden Jubilee volume will be $8.50. Orders should be placed with The American Phytopathological Society, P. O. Drawer 1106, New Haven 4, Conn. Publication date will be winter 1958, but orders should be placed early as there will be a limited number of copies printed.

Officers of the American Phytopathological Society during this Golden Jubilee Anniversary are: President: Paul R. Miller, U.S.D.A., Beltsville, Md.; President-elect: Glenn S. Pound, University of Wisconsin; Vice-President: W. C. Snyder, University of California, Berkeley; Secretary: W. B. Hewitt, University of California, Davis; Treasurer: Saul Rich, Connecticut Agric. Experiment Station, New Haven; Editor-in-chief, *Phytopathology:* E. E. Wilson, University of California, Davis; and Retiring President: George W. Fischer, Washington State College, Pullman.

Members of the Fiftieth Anniversary Committee are: Wayne Bever, D. E. Ellis, J. G. Harrar, W. B. Hewitt, C. S. Holton, G. S. Pound (Chairman), H. A. Rodenhiser, J. R. Shay, and R. H. Wellman.

• **The American Society of Naturalists** elected the following officers for 1958: President: G. Evelyn Hutchinson; Vice-President: Jack Schultz; Treasurer: George Sprague; Secretary: Bruce Wallace, Biology Laboratory, Cold Spring, L. I., N. Y. (After September 1, Department of Plant Breeding, Cornell University, Ithaca, N. Y.); Representative to AIBS Governing Board: Clark Dalton.

• Effective January 1, 1958, the **Secretary of the Ecological Society of America is John E. Cantlon,** Department of Botany and Plant Pathology, Michigan State University, East Lansing.

• 1958 officers of the **American Ornithologists' Union** are: President: Ernst Mayr; First Vice-President: Austin L. Rand; Second Vice-President: George H. Lowery; Editor: Eugene Eisenmann; Treasurer: Charles G. Sibley, Cornell University, Ithaca; Secretary: Harold F. Mayfield, Waterville, Ohio.

During the annual 1957 meeting of the Union held at Cape May, September 10-15, the **Brewster Memorial Award for a published work on American birds was given to Robert P. Allen** of Tavernier, Florida, for his life history studies of the large wading birds.

The 1958 meeting of the Union, which will celebrate its 75th anniversary, will be held October 14-19 in New York City.

• **The American Society of Parasitologists** during its joint meeting in Philadelphia, October 30-November 2, 1957, with the American Society of Tropical Medicine and Hygiene elected the following officers for 1958: President: Arthur C. Walton; President-Elect: Aurel O. Foster; Vice-President: Raymond M. Cable; Treasurer: Robert M. Stabler; Secretary: Paul E. Thompson, Research Division, Parke, Davis & Co., Detroit, Michigan; Representative to the AIBS Governing Board: Arthur C. Walton.

• **The Potato Association of America** elected the following officers for 1958: President: N. R. Parks, Ottawa, Canada; Vice-President: Paul J. Eastman; President-Elect: W. J. Hooker; Treasurer: J. C. Campbell; Secretary: R. V. Akeley, Vegetable and Ornamentals Research Branch, Agricultural Research Service, U.S.D.A., Beltsville, Maryland; Directors: D. J. MacLachlan, E. J. Wheeler, O. C. Turnquist.

• Officers for 1958 for the **American Society of Limnology and Oceanography** are: President: Dale F. Leipper; Vice-President: Robert W. Pennak; Secretary-Treasurer: Bostwick H. Ketchum, Woods Hole Oceanographic Institution, Woods Hole, Mass.

• The 1958 officers of the **National Association of Biology Teachers** are: President: Irene Hollenbeck; President-Elect: Paul Klinge; First Vice-President: Dorothy Matala; Second Vice-President; Irving C. Keene; Third Vice-President: Robert L. Smith; Secretary-Treasurer: Paul V. Webster, Bryan City Schools, Bryan, Ohio; Representative to the AIBS Governing Board: Samuel L. Meyer.

• **The Hawaiian Botanical Society,** whose membership is largely made up of professional botanists, elected the following slate of officers for 1958: President: Paul Weissich; Vice-President: Donald Gowing; Treasurer: William Bush; Secretary: Irwin Lane, University of Hawaii, Honolulu; Executive Committee: Robert Cushing, Oscar Kirsch; Membership Committee: Shosuke Goto, John Warner, Amy Suehiro.

• **The Southern Section of the American Society of Plant Physiologists,** at a two-day meeting in February, 1958, in Little Rock, Arkansas, elected the following officers: Chairman: Aubrey W. Naylor; Vice Chairman: Howard J. Teas; Secretary-Treasurer: Robert E. Burns, Agricultural Research Service, U.S.D.A., Experiment, Georgia.

• **The Society of General Physiologists** will hold its 1958 annual meeting at the Marine Biological Laboratory, June 9-11. Contributed papers and the business meeting are scheduled for the first day. A symposium on "Subcellular Particles and Their Function" has been organized by Teru Hayashi of Columbia University. Dormitory accommodations at the Marine Biological Laboratory may be obtained by writing directly to Mrs. Lila S. Meyers, Marine Biological Laboratory, Woods Hole, Mass., before May 1.

• **The Board of the Federation of American Societies for Experimental Biology** for 1957-1958 is composed of: L. N. Katz, Hallowell Davis, A. C. Burton, American Physiological Society; J. T. Edsall, Philip Handler, H. E. Carter, American Society of Biological Chemists; Otto Krayer, Harold C. Hodge, Harry Beckman, American Society for Pharmacology and Experimental Therapeutics; E. D. Warner, J. F. A. McManus, F. W. Hartman, American Society for Experimental Pathology; R. R. Williams, G. M. Briggs, R. W. Engel, American Institute of Nutrition; J. H. Dingle, F. S. Cheever, M. W. Chase, American Association of Immunologists; A. C. Burton, Chairman; M. O. Lee, Federation Secretary.

• The papers presented during the **Botanical Society of America's Fiftieth Anniversary Program "Fifty Years of Botany,"** that originally appeared in the *American Journal of Botany* will be published shortly in book form by the McGraw-Hill Book Company.

• The annual meeting of the **Animal Disease Research Workers in the Southern States** was held at Stillwater, Oklahoma, March 6-7, 1958. The following officers were elected for the coming year: President: J. C. Osborne, Raleigh, N. C.; Vice-President: L. R. Davis, Auburn, Ala.; Secretary-Treasurer: A. L. Kleckner, Athens, Ga.

• **The Society of Protozoologists** has announced the publication of "A Catalog of Laboratory Strains of Free-living and Parasitic Protozoa." Sources from which protozoans may be obtained and directions for maintenance are included. The Catalog appeared as part of the February, 1958, issue of *Journal of Protozoology*. Reprints of the Catalog will be sold at nominal cost. Orders should be placed with Dr. D. M. Lilly, Treasurer, Society of Protozoologists, Department of Biology, St. Johns University, Jamaica 32, N. Y.

• **The Eighteenth Annual Meeting of the Association of Southeastern Biologists** was held at Florida State University, Tallahassee, April 17-19, 1958. The meeting was joint with the Southeastern Section of the Botanical Society of America, the Southern Appalachian Botanical Club, and the District Convention of the Beta Beta Beta Biological Society. W. F. Loomis delivered an address on "Chemical Control of Sexual Maturation in Hydra," and the Annual Presidential Lecture was delivered by George C. Kent. Three field trips were planned in connection with the meeting.

• **The American Phytopathological Society for several years has sponsored the publication of results from tests on newer fungicides.** The "Results of 1957 Fungicide Tests" for the first time has been printed privately and is issued as a single copy. This replaces the previous practice of combining reprints of serial articles published in *Agricultural Chemicals*. The "Results of 1957 Fungicide Tests" can be secured at $1.00 per copy only from Dr. A. B. Groves, Department of Plant Pathology and Physiology, Winchester Fruit Research Laboratory, Rural Route 3, Winchester, Virginia. All orders should be accompanied by remittances made out to The American Phytopathological Society. An added charge will be made for postage and handling where orders must be billed.

• ***Careers in Animal Biology*, a brief brochure describing career opportunities in animal biology, has just been published by the American Society of Zoologists.** The brochure is designed to help college students and high school seniors find out about the positions that are currently available to young people with varying degrees of biological training. The 16-page book describes specifically the kinds of jobs available, in both basic and applied biology, in schools, universities, research institutes, hospitals, government agencies, and industrial laboratories. It includes information about the duties of each position, kind of preparation required, opportunities for advancement, and salary to be expected. Written by Prof. Howard L. Hamilton, Iowa State College, the booklet is a product of the ASZ Subcommittee on Education. Copies may be obtained from the Secretary of the Society, Dr. Gairdner Moment, Goucher College, Towson, Baltimore 4, Md. The price is 15 cents for a single copy, or in bulk: 25 copies, $3.50; 50 copies, $6.50; 100 copies, $11.00; 1000 copies, $80.00.

Education and Manpower

• ***Study Abroad*, a handbook published by UNESCO,** in its 1957-1958 edition more than 75,000 international scholarships and fellowships for study in 83 countries and dependencies. The handbook includes information on eligibility requirements, application procedures, amount of awards and length of courses. It also lists 250 information centers in 50 countries which advise foreign students on living conditions, tuition fees and enrollment procedures.

According to the previous year's report (1955-1956), a total of 140,744 persons studied outside of their countries. 36,494 came to the United States (more than any other country). France with 16,877 foreign students was second, followed by the U.S.S.R. with 12,300. *Study Abroad* may be obtained ($2.50) from UNESCO Publications Center, 801 Third Avenue, New York 22, N. Y.; UN Bookshop; and Columbia University Press, 2960 Broadway, New York 27, N. Y.

• **For the sixth year in a row, college enrollment set a new record in 1957.** A total of 3,068,000 students were enrolled in 1,890 colleges and universities, an increase of 4.1 percent over the 1956 enrollment. These figures appeared in the January issue of *Higher Education*, a publication of the U.S. Office of Education. 45 percent increase in fall enrollments occurred from 1951, the year of lowest enrollments since World War II. Nearly two-thirds of the 1957 college student body are men. The ten institutions which led in the number of students in 1957 are as follows: University of California (all campuses), 41,598; University of Minnesota (all campuses), 35,852; New York University, 31,068; State University of

New York (all campuses except A & PI), 29,583; City College of the City of New York, 28,181; Columbia, 26,787; University of Michigan, 26,370; University of Illinois, 25,920; University of Wisconsin (all campuses), 24,873; and Ohio State University, 22,611. Of the total college population, 58 percent were attending publicly controlled institutions. States with increases of 10 percent or more included: Delaware, Virginia, Maine, Arkansas, New Mexico, Arizona, Oregon, Massachusetts, and New Jersey. Fewer college students were reported in three states; the largest decrease was in Nevada.

• **St. Olaf College, Northfield, Minnesota, has initiated a two-year program of summer institutes.** The college recently received an $11,000 Louis W. and Maude Hill Family Foundation grant for the science and youth program. At least 80 promising high school students will travel to the campus for a week of science orientation, beginning June 9, 1958. A similar program will be followed in 1959.

Three goals have been outlined for the program by a science and mathematics planning board: (1) To provide a look at what a science career is like—how the scientist thinks and works, what constitutes a research environment in industry or at a university. (2) To create an appreciation of the breadth of activities in science and to show how the sciences are interrelated and interdependent. (3) To show the importance of thorough training in high school and college, not only in science and mathematics but also in key supporting subjects such as English, speech and foreign languages.

• **Nearly 50,000 persons have benefited by the provisions of the U.S. Informational and Educational Exchange Act of 1948** during the decade that it has been in operation. The Smith-Mundt Act, as it has come to be known, has made possible the exchange of 14,000 Americans and 36,000 foreign nationals from more than 80 countries. Of these, the largest number (24,000) were graduate students. Besides administering these government-sponsored exchanges, the Department has also assisted privately sponsored exchanges involving approximately 6,000 annually.

• ***Teacher Supply and Demand in Colleges and Universities,*** a study conducted by the Research Division of the National Education Association, has now been published in booklet form. Single copies will be sent free upon request. Officials wishing to distribute this report to faculty councils, trustees, boards of control and legislative committees, need only indicate the number desired. All requests should be addressed to: Research Division, National Education Association, 1201 Sixteenth Street, N. W., Washington 6, D. C.

• Plans for broadening the opportunities for secondary school teachers and teacher candidates to improve their background in biology are being developed at **Brown University** in connection with the University's **Master of Arts in Teaching program,** now in its first year. The University will offer, in the fall of 1958 for the first time, teaching assistantships in the biology department to recent graduates enrolled in the M.A.T. program who have had good undergraduate training in biology. These posts will be offered as an incentive toward additional training in subject matter depth and in teaching techniques prior to taking high school teaching positions. Graduates of teacher's colleges, who may be thoroughly equipped in teacher-training but lack depth in biology, will be offered one-year scholarships which would enable the student to take courses in biology and related areas on a full-time basis. Satisfactory completion of the year's work would lead to offers of teaching assistantships in the biology department. For the third group of M.A.T. students, the in-service teachers who have demonstrated success in secondary school biology teaching and who have a proven academic record, a program of financial support has been set up which will include a cost of living stipend and other sufficient funds to enable them to devote full time to the M.A.T. course while on leave of absence from their teaching positions. Masters in the Art of Teaching program is open to men and women holding Bachelor's degrees or their equivalent either from liberal arts colleges or from teacher-training institutions. Other science departments in the University are considering similar opportunities, but are not yet ready to announce a definite program. Information about the proposed biology program may be obtained from the Office of the Dean of the Graduate School, Brown University, Providence 12, R. I.

Letters to the Editor

March 18, 1958

Much has been said about the biologist's responsibility for clarity in technical writing and for good exposition for the layman (e.g. AIBS Bulletin 7(5): 13), but not many of us do much about it. L. C. Maisenhelder and C. A. Heavrin have! In a serious, technical article (American Society of Foresters Proceedings, 1956: 73-75) they describe the silvics and silviculture of cottonwood and willow along Old Man River in language that is technically sound and precise but is beautiful and highly readable (you can almost hear the banjoes plunking in the background). As a professional specialist in the technical field, I bow to them. As a ham artist, I bow to them again and even more deeply. This I will hold up to my graduate students as exemplary!

John P. Decker, U.S.D.A. Forest Service, Arizona State College, Tempe, Arizona.

March 24, 1958

There is little doubt, as Dr. Cox has pointed out in his editorial "Where Now?" (AIBS Bulletin 8(1): 11) that the biologists have failed to "sell" themselves to the public. Wise in the ways of communication within their own special fields—in fact required to communicate, in the form of technical papers in order to be recognized for the quality of their work—the biologists have fallen down badly in public relations. This is not a failure that warrants criticism because the biologist is primarily a scientist—a man devoted to a search for knowledge, and in deriving his personal satisfactions from discovery, has little reason to be concerned that the general public may not recognize his accomplishments or his contributions to society.

At the same time the public must not be criticized for a failure to appreciate the biological scientist. The public must be considered uninformed until a story or stories are presented, in terms that can be understood. The public, along with legislators, civic officials and community and national leaders can only evaluate the importance of any field of science in the light of what they know.

But living as a member of a competitive society, whether this competition be for more money, a larger market, or to gain support and recognition of a professional group, the biologist must be prepared to promote his own activities before the public or else support the efforts of some representative agency in such activities. Assuming that there is support for such an agency, what sort of promotional efforts should be made that will (1) adequately inform the public of the contributions of the biologists to society, (2) point up the urgent need for continued basic research as the only guarantee of future progress, but (3) not debase the science by reducing it to do-it-yourself terms. I would propose the following:

1. Maintain continuous personal contact with those members of Congressional committees that are holding hearings on development of a Federal Science program to be sure that their thinking is oriented in such a way that the biological sciences will not be overlooked.

2. Arrange to have prominent qualified biologists testify before these committees.

3. Institute a long-range public relations program which would keep notices of biological research developments before the public. This would operate primarily by stimulating research scientists to prepare articles for publication in popular journals, by lining up interview-type articles prepared by the editorial staff of popular publications, and by an expanded press release service.

4. The initiation of a long-range educational recruiting program by the preparation of guidance literature.

These are but a few preliminary proposals. Much more could and must be done to see that the biologists interested are properly protected. *Colin Campbell, 7817 Stratford Rd., Bethesda, Md.*

A.I.B.S. Reports

• The Selection Committee appointed by various zoological societies to review applications for **NSF travel grants to the Fifteenth International Zoological Congress in London** has chosen the following biologists: E. F. Adolph (University of Rochester), Herbert Friedman (Smithsonian Institution), Robert C. King (Northwestern University), Jerry J. Kollros (University of Iowa), John H. Lockhead (University of Vermont), Beatrice Mintz (University of Chicago), Norman D. Newell (American Museum of Natural History), Ellis L. Yochelson (U.S. Geological Survey), Ernst Florey (University of Washington), Richard J. Goss (Brown University), Carl L. Hubbs (Scripps Institution of Oceanography), J. Chester Bradley (Cornell University), G. W. Wharton (University of Maryland), Cecilie Leuchtenberger (Western Reserve University), James A. Peters (Brown University), Donald P. Costello (University of North Carolina), Myron Gordon (American Museum of Natural History), Morris Rockstein (New York University College of Medicine), John L. Brooks (Yale University), J. T. Medler (University of Wisconsin); **eligible for MATS support:** Vincent Dethier (Johns Hopkins University), Talbot Waterman (Yale University).

• The Selection Committee appointed by microbiological societies to review applications for **NSF travel grants to the Seventh International Microbiological Congress in Stockholm** chose the following persons: Stephen Zammanhoff (Columbia University), Samuel Ajl (Walter Reed Army Institution of Research), L. M. Black (University of Illinois), Earl Maramorosch (Rockefeller Institution for Medical Research), Herbert Morgan (University of Rochester), Jack Newton (Brandeis University), Neal B. Groman (University of Washington), Robert J. Fitzgerald (National Institutes of Health, Bethesda, Md.), Martin Kamen (Brandeis University), Hilary Koprowski (Wistar Institute, Philadelphia, Pa.), Thomas Weller (Harvard University), Gunther Stent (University of California), William Taliaferro (Univeristy of Chicago), Elliot Volkin (Oak Ridge National Laboratory), Roger Herriott (Johns Hopkins University), Otto Pleasia (Rutgers University), Julius Younger (University of Pittsburgh School of Medicine), T. Makinodan (Oak Ridge National Laboratory), Howard Gest (Western Reserve University, School of Medicine), Martin Alexander (Cornell University); **to receive SAB grants:** Joshua Lederberg (University of Wisconsin), Aaron Novick (University of Chicago), Werner Braun (Rutgers University), G. Bertai (University of Southern California Medical School), David Karzon (University of Buffalo School of Medicine); **eligible for MATS support:** J. Roger Porter (State University of Iowa), H. Albert Gordon (University of Notre Dame), Samuel Beiser (Columbia University), A. Eisenstark (Kansas State College), Edward D. Garber (University of Chicago), Stanley Marcus (University of Utah), Felix Haurowitz (Indiana University).

• **The AIBS Ad Hoc Committee to the Atomic Energy Commission on Summer Institutes in Radiation Biology** met in New York, January 31, 1958.

• The AIBS arranged an **Ad Hoc meeting of the directors of AEC Summer Institutes in Radiation Biology** at the University of New Mexico, Albuquerque, February 28-March 1. The meeting was called for the purpose of bringing together the directors of the new summer institutes to discuss common problems and to hear presentations from the directors of two former institutes.

• Under the auspices of AIBS and the sponsorship of the Office of Naval Research and the Naval Bureau of Aeronautics, a **Symposium on Basic Research to the Development of Shark Repellents** was held at New Orleans, April 8-11.

• **The AIBS Advisory Committee on Biochemistry to the Office of Naval Research** met April 13, in Philadelphia, Pa. The Committee discussed the scientific merits of five research proposals and reviewed various policy matters pertaining to the Biochemistry Branch of the Office of Naval Research.

• On April 13, 1958, the **AIBS Advisory Committee on Physiology to the Office of Naval Research** met in Philadelphia, Pa. Ten research proposals received the attention of the Committee.

• At the 1957 meeting of the **AIBS Governing Board,** held at Stanford University, it was decided that two meetings should be held in 1958. The first meeting of the new year is now scheduled for May 9-10, at the University of Wisconsin, Madison.

• **The Conference of Biological Editors** will meet in Washington, D. C., at the Dupont Plaza Hotel, May 3-4, 1958. Further information may be obtained from the Secretary-Treasurer, Dr. Fred Cagle, Tulane University, New Orleans, La.

The Conference, through the AIBS, has obtained a grant from the National Science Foundation, to support the preparation and publication of a Style Manual in biology. The program is under the direction of Roger Porter, State University of Iowa.

• **The AIBS Publication Committee,** under the chairmanship of John Behnke, met in Washington, D. C., February 11-12, 1958. With the formation of the Conference of Biological Editors (April 1957) many of the activities of the Publications Committee were appropriately preempted. The Committee discussed thoroughly the need for two organizations and decided in favor of retaining the Publication Committee to handle over-all policy for AIBS in the field and the management of projects not being undertaken by C.B.E. The Committee expressed gratification in the establishment of the new National Federation of Science Abstracting and Indexing Service, as reported by Miles Conrad. The status of the proposed Style Manual for biology was discussed (see above for more recent action). The Subcommittee on Review Articles and Books, under Carl Swanson, was asked to investigate the possibility of finding more outlets for review articles and to encourage more biologists to prepare review articles. The possibility of underwriting competent reviews received attention. This Subcommittee will also continue to assist AIBS in the selection of Russian literature in biology for translation.

A central editorial-management office for biological journals has been under consideration for several years. The Committee was told of a plan to bring interested editors of Member Society journals together for a meeting this spring (date not set). Matters of copyrights were discussed and it was agreed that the AIBS legal counsel would investigate any situations that arose.

The Committee voted to recommend to the Governing Board that the Publications Committee be reduced to seven members with the prerogative of inviting consultants for particular problems in the future.

• In line with its policy of trying to gain greater professional and financial recognition for biologists employed by the Federal Government, **AIBS is making a comparative statistical study of salaries** in 1954 against those in 1956. The study will separate full-time biologists by sex, degree, employer and professional specialty. Within each of these categories mean salaries will be calculated.

Data for these studies were provided by the AIBS section of the National Register of Scientific and Technical Personnel.

AIBS plans to present these studies before the Civil Service Commission in the latter part of April. An article will appear in the June issue of the AIBS Bulletin on the results of the study.

• **Methods by which artificial earth satellites can be used to further basic research in biology will be the subject of a four-day symposium, May 14-17,** to be sponsored jointly by the National Academy of Science, the American Institute of Biological Sciences and the National Science Foundation. Tentative meeting place is the National Academy of Sciences building in Washington. A steering committee, composed of representatives of all three organizations, has announced three main objectives: (1) to exchange information concerning the tech-

nical feasibility and scientific importance of various experiments with living organisms in the satellite environment. (2) to discuss methods and techniques for conducting such experiments, including associated laboratory work. (3) to stimulate thinking which will lead to a sound program of research in the life sciences through the use of earth satellites. Attendance at the symposium will be by invitation only; invitations will be sent to about 200 biologists, biochemists, biophysicists, psychologists, medical scientists and others whose fields of study have prepared them to participate actively in a program of satellite experimentation. Approximately 30 papers will be presented.

• **For persons attending the Indiana AIBS meeting with their families, attractive accommodations are available in limited quantity at two Indiana state parks,** Brown County and McCormick's Creek, each about 16 miles from Bloomington on paved roads. Both parks have swimming pools and other recreational facilities, in scenic settings. Rates are the same at each: $7.85 per person per day, with three meals, for a room with bath; $7.25 per person for rooms with hot and cold running water; children under 8, $3.00 with meals; children 8 to 14, $5.00 with meals. Rooms at Brown County are in cabins separate from the lodge where meals are served. Reservations are not made at either park earlier than 60 days in advance. Use the registration and housing application form found elsewhere in this issue. Both parks have extensive camping facilities, with a charge of 50 cents per night for tents or trailers, plus 25 cents for electricity. Reservations are not necessary for camping.

• **Bloomington area hotels and motels are as follows:** Campus Club (All detached baths—all air-conditioned), Indiana University Campus; Indiana Hotel (Week rates only), 117½ East Kirkwood Avenue; Pullman Hotel (Running water—bath), 224 West Kirkwood Avenue; Tourner Hotel (All air cooled—running water—bath), 127 South College Avenue; Union Building (All with bath), Indiana University Campus; University Hotel (All air-conditioned), State Road #37, North; Van Orman-Graham Hotel (Air conditioning adds about $1.50 per night), 205 North College Avenue; Shady Acres Motel (Air cooled), 1400 North Walnut Street; Stony Crest Motel (All air-conditioned), 1300 North Walnut Street; Twin Lake Motel (Air-conditioned units $1.00 more), Bloomfield Road, West.

• **A number of biological societies are planning field trips** either before or after the scheduled AIBS meetings in Bloomington. The preliminary information given below is to aid prospective participants in filling out the preregistration form given elsewhere in this issue. More detailed information will appear in a subsequent issue.

American Bryological Society, Aug. 23-24. Forays out of Greencastle, Indiana, to Fern, Fallen Rock, Sword Moss Gorge, sandstone and limestone habitats, Camp Friend, and Hoosier Highland.

American Fern Society, 3 or 4 days including Aug. 23. The party will start at Columbus, Ohio, work through the Cincinnati region and end up at Bloomington.

American Phytopathological Society. Open house in the Department of Botany and Plant Pathology, Purdue University, Aug. 23 and up to 3 p.m. on Aug. 24. Open house Department of Plant Pathology, University of Illinois, Aug. 23 and up to noon on Aug. 24.

American Society for Horticultural Science. Field trips in northern Indiana on Aug. 21 and 22. Open house at Agricultural Experiment Station at Purdue on Aug. 23.

American Society of Ichthyologists and Herpetologists, Aug. 26: trips to Spring Mill cave system to observe cave fish; and to goldfish hatchery at Martinsville, to Link Observatory and Farm, to Bradford Woods.

Aug. 29: trip to New Harmony, with opportunities for collecting fishes, amphibians, and reptiles.

American Society of Limnology and Oceanography, Aug. 24. Trip to Spring Mill cave system in morning, and to May's Cave in afternoon.

Ecological Society of America, Aug. 29. Field trips to the Spring Mill cave system, and to Pine Hills.

Mycological Society of America, Aug. 22-23. Day-length field trips out of Bloomington. Persons with cars available for transportation are asked to contact Dr. George B. Cummins, Department of Botany and Plant Pathology, Purdue University.

Nature Conservancy, Aug. 29. With Ecological Society to Pine Hills.

Phycological Society of America, Aug. 24. Field trip in Bloomington area.

Potato Association of America. With Society for Horticultural Science.

• **Most biological societies meeting with AIBS at Bloomington are planning some kind of dinner.** Those already scheduled appear below:

Aug. 25 *breakfast:*
American Bryological Society
luncheon:
American Fern Society
American Microscopical Society
dinner:
American Society of Plant Physiologists
American Society of Plant Taxonomists

Aug. 26 *luncheon:*
Animal Behaviorists
Society of Protozoologists
dinner:
American Society for Horticultural Science
Ecological Society of America
Society for Industrial Microbiology
Potato Association of America

Aug. 27 *luncheon:*
American Society of Parasitologists
dinner:
American Phytopathological Society
American Society of Ichthyologists and Herpetologists
American Society of Zoologists
Botanical Society of America
Mycological Society of America (with Phytopathologists)

Aug. 28 *luncheon:*
Nature Conservancy

Biology Library

One copy of each publication submitted for listing should be sent to the Editor, AIBS Bulletin, Amer. Inst. of Biological Sciences, 2000 P Street, N. W., Washington 6, D. C. Only books published within a year of receipt will be reviewed. Books marked with an ★ are those published by Bulletin advertisers.

ANIMAL SCIENCES

Reptiles Round the World. CLIFFORD H. POPE. 194 pgs., illus. Alfred A. Knopf, New York (1957) $3.50

It is a pleasure to have the opportunity of bringing to the attention of fellow biologists any book which provides accurate, well-written and appealing biological information to young readers. This reviewer is at present engaged in this precarious aspect of scientific education, and is well aware of the pitfalls and problems in attempting such a task. Dr. Pope has contributed an excellent little excursion into natural history which will, I hope, find a place on the reading shelf of every young naturalist and future biologist. The publisher has cooperated by turning out a fine looking volume, in eye-catching format and appeal.

Clifford Pope is a past president of the American Society of Ichthyologists and Herpetologists, and has been on the staff of the American Museum of Natural History and the Chicago Natural History Museum. At present he is devoting full time to writing. The illustrator, Helen Damrosch Tee-Van, is well known for her work at the New York Zoological Society; her black-and-white illustrations contribute a lively and unorthodox supplement to the text.

As the title indicates, this book for boys and girls is world-wide in its scope. Part I is devoted to eighteen short, vivid chapters on reptile biology, each of general appeal. They include such topics as locomotion, size, age, eating habits, survival problems, ancient reptiles, reptiles as pets, how and where to find reptiles. Part II deals with reptile distribution, of which only a very small part is that of the United States. It is unfortunate that more space could not

have been devoted to our native species, less to Australia and India. Young people are most likely more interested in what reptiles they can themselves find, than those of foreign lands. But on the whole, the content is well chosen. *C. J. Hylander, Silver Springs, Fla.*

★The Life of Mammals. J. Z. YOUNG. 820 pgs., illus. Oxford University Press, New York. (1957) $10.00

To the field biologist or ecologist, the title of this exciting book is misleading. For while Young recognizes the importance of behavior and field studies, and gives due credit to such, he dwells primarily on the organism from the point of view of anatomy, physiology, histology, biochemistry and biophysics which provides the symbols for describing and influencing adult living organisms. Thus Young is concerned with the control mechanisms by which life is maintained. The usual processes of life are considered in the light of new techniques and methods recently developed by the experimental biologist. The 47 chapters treat in considerable detail of the various organs and their specialized tissues, physiology of digestion, respiration, circulation, nervous system (156 pgs.), endocrines, reproduction in great detail, and the development of the various systems. The rabbit and rat are given special attention, with excellent new illustrations embellishing the text.

Young has attempted, with marked success, to bridge the gaps between the basic and medical aspects of biology. A novel introduction is the detailed discussion of biological methods, which shows the reader how many parts of the subject are imperfect and how "they can be illuminated by use of a new language that considers the body as a self-controlling machine." An excellent bibliography with selected references to each chapter is included. The volume is designed for the advanced student of biology and medicine. It is not light reading, but will certainly fill a most pressing need. *W. J. Hamilton, Jr., Cornell University.*

Methods for Obtaining and Handling Marine Eggs and Embryos. D. P. COSTELLO, M. E. DAVIDSON, A. EGGERS, M. H. FOX and C. HENLEY. 247 pgs. Lancaster Press, Lancaster, Pa. (1957) $3.50

This manual is a compilation of the methods for handling embryological materials available at Woods Hole, Massachusetts. In the past, much valuable time-saving information has been lost because it was passed from investigator to investigator merely by word of mouth. Many tried and tested methods of handling marine eggs and embryos developed during sessions of the Embryology Course at the Marine Biological Laboratory have heretofore been unrecorded. Thus, the present manual promises to be considerably valuable to both experienced and new investigators who plan to continue or begin work with marine materials of the Woods Hole Area. It is apparent that the methods may also be used to advantage elsewhere.

The contributors to and compilers of this manual are to be congratulated for their worthy efforts which have resulted in this comprehensive and pleasingly thorough coverage of the material. Methods for handling each kind of egg and embryo are described separately and consist of statements under the following headings: Living Material (local occurrence), Breeding Season, Procuring and Handling Material, Normal Development (brief summary), Special Comments and References (selected). *Nelson T. Spratt, Jr., National Science Foundation.*

★Animal Behavior. JOHN PAUL SCOTT. 281 pgs., illus. University of Chicago Press, Chicago, Ill. (1958) $5.00

This volume provides a pleasant and nontechnical introduction to the subject "for the general reader or the student who wishes to learn something for himself." It presupposes no high degree of sophistication in biology or social science, but presents a fairly broad sampling of the field of animal behavior. The examples are chosen more from observation than from experiment, and more from birds and domesticated mammals than from other kinds of animals. The author gives his reader stimulating descriptions and does not overtax him with involved discussions of theoretical issues. His coverage of social behavior is comprehensive and his treatment of the role of heredity in behavior is particularly satisfying.

Two introductory chapters elucidate the importance of animal behavior for other disciplines, survey problems of methodology, and present a classification of behavior into nine basic categories: ingestive, shelter-seeking, agonistic, sexual, care-giving, care-soliciting, eliminative, allelomimetic, and investigative. Chapters 3 to 7 deal with the "causes of behavior": anatomy, physiology, learning, heredity, and intelligence. The last four chapters cover the "results" of behavior: social organization, communication, and relations to the environment and to the process of evolution.

The field of animal behavior, as the author points out, is an extremely broad one, its study comprehending "all branches of zoology," and it is "also an interdisciplinary study of a large scale, involving findings from psychology, sociology, and the physical sciences." This acknowledged breadth of the field poses a difficulty and a challenge.

The difficulty is to do justice to the many and varied approaches to the field, and in this respect one may question whether Dr. Scott's book has given proportionate attention to all sources of information. In terms of sheer volume and concentration on behavior as such, comparative psychology has probably done more in the field than all others combined. The fact that many of these studies are highly specialized and are often guided by precise theoretical formulations does not mean that they may be slighted in a general treatise on animal behavior. We are grateful to Scott that he has taken cognizance of so many areas of work on animal behavior, but we cannot condone his cavalier neglect of the earnest efforts which have been made to bring system and organization into the field. Except for the chapter on learning which gives a rather elementary account of the work of Pavlov and of Skinner, the present volume gives but a faint notion of the extensive systematic contributions of comparative psychology.

The challenge posed by the breadth of the study of animal behavior is, of course, to bring unity, logical cohesiveness, and theoretical organization into the great mass of material. One step in this direction the author has taken when he says that "what an organism does is more important than what it is." The implication of this statement is that animal behavior is something more than an interdisciplinary science, more than a combination of the various zoological subsciences; that it is, instead, a science in its own right, correlative with other major life sciences. Beyond this statement of faith, however, Scott depends on just one concept to hold together the manifold forms and aspects of animal behavior: adaptation. This is without doubt a very useful concept, despite its teleological flavor, but Scott exploits it far beyond reasonable and accepted limits. The stimulus-response theory, he says, is the one basic generalization developed by behavior scientists. "Essentially this is a very simple idea: that behavior, which is called a response, always has some sort of cause which precedes it." Nevertheless, "we can define a response only as an attempt to adapt," and "according to the stimulus-response theory, behavior is essentially an attempt to adapt to change." Certainly the biologist may look at all behavior as a striving to survive, but it is confusing to label the adaptive process with a term, stimulus-response, which traditionally refers to interpretations that avoid the concept of adaptation. *Henry W. Nissen, Yerkes Laboratories of Primate Biology.*

Insect Life in the Tropics. T. W. KIRKPATRICK. 311 pgs., illus. Longmans, Green, and Co., New York, N. Y. (1957) $7.00

The accumulated experiences of years of studying and working with insects in the tropics are vividly portrayed by Mr. Kirkpatrick in these pages. Although the book is not primarily intended for the professional entomologist, the author makes no apology for using technical terminology where it can better convey his ideas. Emphasis has been laid on types of life histories and behavior with many of the observations having been made by the author. Most of the examples are drawn from insects occurring in East Africa or Trinidad, with a few based on insects

studied in Egypt and the Sudan. The book begins with an excellent discussion of the tropical environment, then continues with an elementary treatment of insect structure, including a small, but interesting, section on insect size. Classification, development, reproduction, locomotion, foods and feeding habits, defense and protection, insect architecture, and insect communities are handled in a most competent and readable manner. The book is well illustrated with 146 figures most of which are original. *Insect Life in the Tropics* is heartily recommended for interesting and informative reading. *Lewis Berner, University of Florida.*

The Ants. WILHELM GOETSCH. Translated by Ralph Manheim. 169 pgs., 85 figs. Univ. of Michigan Press, Ann Arbor. (1957) $4.50

First published as *Die Staaten der Ameisen* in Germany, this English translation by Ralph Manheim appears as a volume in the Ann Arbor Science Library. The author has been connected with the Universities of Graz, Breslau and Wroclaw and is now understood to be living in Spain. Dr. Goetsch is an original worker and the book reflects his investigations in Europe and two productive trips to South America over 20 years ago. It was he who proposed a vitamin T from insects and this and some of his other theories have not been universally accepted. He perpetuates an old myth on p. 77 when he implies that the collections of enlargements at the ends of ant fungi develop as a result of cultivation but correctly points out the role of ant saliva in maintaining fungus gardens. His theory that *Hypomyces* has any special relation to the normal ant fungus needs verification. A better explanation for the success of the Argentine ant is now at hand from the work of Pavan and colleagues in Italy. Familiar diagrams of ant internal anatomy from Janet and Wheeler (without credit) appear but the great majority of other diagrams are original and of especial value. These suggest many interesting experiments that one could perform. The ant he refers to as *Dorymyrmex goetschi* was named as a subspecies of *tener* by the describer, a case of "poetic license."

The book is well translated and its small size with large type makes it convenient to use. It is all in all a stimulating and worthwhile volume that should interest many people who have nature as a hobby and is at the same time a useful summary for the biologist. *Neal A. Weber, Swarthmore College.*

***Introduction to General Embryology.** A. M. DALCQ. Translated by Jean Medawar. 177 pgs., illus. Oxford University Press, New York. (1957) $6.50

In the rush of academic affairs it is pleasant to spend an evening or two meditating on the foundations of a science such as embryology. Professor Dalcq has provided such an opportunity in this pleasing little book. Its 8½" x 5½" format, the clarity and selection of the many figures and readability of the text add to the pleasure.

The title is in error. "Introduction" is a relative word, but it usually implies that the definitive volume could be written if only the readers were sophisticated enough. For many of the topics treated here an "Introduction" is the beginning and end of our knowledge. It might better have been titled "Essays on Embryology." It is in this sense that Professor Dalcq, who is one of those who "has been privileged to know some of the men who accomplished this task—and (has) heard from their lips" of the gropings of earlier investigators, and who has, at the same time, been a leader in the development of many of our current notions, wrote this book.

In 1951 these essays were delivered as a series of broadcasts for *Université Radiophonique* of Paris but they have been substantially updated for the English edition.

The limitations of length can excuse certain omissions; the index is incomplete; and, for an "Introduction", some of the terminology is unnecessarily esoteric, e.g., acromerite, ditremes, normogenesis, etc. Chapters I to IX are brief but well done presentations of the usual background necessary for an understanding of "causal embryology." Chapters X, "Morphogenetic Potential," and XI, "Mammals: A Special Case," are important expositions of Professor Dalcq's recent research and thinking. Chapters XII, XIII, and VIX cover heredity, evolution, and speculations on "the current status" and make good reading. Some controversial ideas are presented in these chapters.

Those who know and have heard Professor Dalcq can only admire the skill with which Jean Medawar captured the flavor of his language. The book is a must; for mature biologists, for graduate students facing their "prelims," and for inquisitive undergraduates. *George W. Nace, University of Michigan.*

The Fishes of Ohio, with Illustrated Keys. MILTON B. TRAUTMAN. 683 pgs., 172 figs., 7 color plates, 172 maps. The Ohio State University Press in collaboration with the Ohio Division of Wildlife and the Ohio State University. Columbus, Ohio. (1957) $6.50

This magnificent work, marking the culmination of over 30 years of effort, is surely the most complete regional treatise in the history of North American ichthyology. In the Introduction (Part I), an illustrated geological history of Ohio is given in brief, concise and documented form. A historical review of the writings of early explorers and personnel of military campaigns depicts ecological changes in Ohio since 1750 and affords delightful reading in Part II. Parts III and IV are devoted to nomenclatural matters including an alphabetical arrangement of synonyms of Ohio fishes, with literature citations and current scientific names. The nomenclature employed is in accord with recent generic mergers, except that the generic names *Clinostomus* and *Pomolobus* are retained until time permits a more thorough study. Part V explains the artificial keys and includes a glossary of technical terms. Although the glossary (pgs. 49-56) is in an unusual position, it is meticulously complete. In the same part methods of counting and measuring fishes are given with excellent and helpful illustrations. The dichotomous key to the families is illustrated with simple line drawings. A workable key to the 160 species and 12 subspecies is followed by a treatment of the species in phylogenetic order. Under each species a brief diagnosis, including coloration and lengths attained and a discussion of distribution and habitat are given. The species are all illustrated by means of exquisite line cuts with stipple shading. Important anatomical details are illustrated by insets. In species having sexual dimorphism or strikingly different juvenile color patterns, additional illustrations are given to minimize the possibility of misidentification. The distribution of each species in Ohio is illustrated on a spot map, with a small inset map to show, roughly, the general range of the species. After a section on literature cited, 7 color plates illustrate 21 species. The volume ends with a complete index. This fine book should be on the shelf of every naturalist whether scientist or layman. The very low price reflects the fine educational objectives of the publishers. A person not personally acquainted with the author might regard the tribute paid by Carl Hubbs (Foreword, XVII) as redundant, but those who have been privileged to follow the development of this masterpiece of ichthyological literature know that Dr. Trautman deserves more than usual praise for a job well done. *George A. Moore, Oklahoma A. & M.*

PLANT SCIENCES

Quantitative Plant Ecology. P. GREIG-SMITH. 198 pgs., illus. Academic Press, Inc., 111 Fifth Ave., New York 3, N. Y. (1957) $6.00

"At the present stage of development of plant ecology, when the great value of a quantitative approach is being apparent, there is a tendency either to apply quantitative methods too enthusiastically, or to apply them to problems to which they are not, or not yet, appropriate." This, to quote from the book, expresses one of the principal underlying values of the book. Throughout, the book is the presentation of statistical procedures that can be applied to vegetation studies and an assessment of relative values of both the procedures and the quantities they measure. The author makes it clear that while in many instances statistics have value related to vegetation, in others their interest may lie solely in the statistics themselves.

The book has considerable value for a student with some background in statistics. It can give him an excellent idea of how his statistical background can be applied to vegetational study. For the person with little or no background in statistics the book also makes a nice contribution. In the first place, one finds throughout the book discussions that enhance one's appreciation of the values of the quantitative methods in their application to plant ecology. In the second place, the discussion of concepts such as climax, succession, reality of communities, etc. from the strict point of view of the statistical ecologist is especially instructive. *Murray F. Buell, Rutgers University.*

★Experimental Control of Plant Growth. FRITS W. WENT. 343 pgs., 25 plates. Ronald Press Company, 15 E. 26th St., New York, N. Y. (1957) $8.50

In this Volume 17 of Chronica Botanica, Professor Went gives a systematic account of the Earhart Plant Research Laboratory (Phytotron), the philosophy guiding its conception and design, the constructional details, and many experimental uses to which it has been put. The book is written in a leisurely style without being unduly verbose. It is divided logically into sections, the first of which begins with general principles of air-conditioned greenhouse design. This leads naturally into specific considerations involved when planning the Earhart Laboratory. This subject is illustrated in adequate detail. There follows a résumé of operational procedures and of performance characteristics which elaborate on methods of handling plants and of measuring plant growth as developed at the Earhart Laboratory. The author may be forgiven for laboring the point that Phytotron performance has been generally satisfactory with regard to those specifications which were (partly a posteriori) found to be important.

A second section of equal length deals with results which have emerged in large part from Phytotron research in some nine years of operation. These, grouped on a plant by plant basis, represent for the most part summaries of work already published in extenso. The viewpoint is autecological and the studies are chiefly descriptive with thermoperiodicity a recurring theme.

A third section consists of miscellaneous generalizations arranged by phenomena rather than by species. That uncontrolled environmental factors contribute to phenotypic variability again is emphasized. There is an unsophisticated though readable analysis of factors determining plant growth kinetics, and of presumptive mechanisms for their operation. A chapter called "Ecology" stresses nyctotemperature and phototemperature, but includes other factors as well as accounting for plant distribution patterns. There appears to be undue emphasis placed on average climatic factors with less appreciation than one might have expected of the importance of intermittently encountered climatic *extremes* in limiting plant distribution. Chapters on germination, mineral nutrition, photosynthetis, and water relations, viewed from the vantage point of an ecologist, round out the section. To these are appended miscellaneous observations and speculations on smog damage, thermal synchronizations with endogenous rhythms, and a chapter emphasizing that temperature conditions of growth control the sensitivity of plants to certain applied chemicals. In sections II and III, Professor Went's account is interspersed by chapters by several of his colleagues.

The concluding chapter sums up achievements of the Earhart Laboratory in establishing simultaneously a wide range of more or less completely controlled environments and reiterates the advantages of reduced variance in a population growth under conditions which are well controlled. Cost data are supplied which, with appropriate inflationary correction, could be brought up to date.

A set of twenty-five plates add to the attractiveness of the volume.

Some minor blemishes occur. Critical readers will notice a number of loose statements (such as the reference to a temperature independent process as one "with practically no temperature coefficient", page 215). Certain conclusions are reached perhaps too glibly (such as the unfortunately dogmatic disassociation of thermoperiodic phenomena from autonomous rhythmic processes, page 220). But on the whole the book accomplishes its modest objective of providing a lucid introduction to the problems, advantages and potentialities of Phytotron construction and operation. For those who hoped for an original treatment of the physiological problems expressed in its title, the book may prove disappointing. What it contains along these lines is mostly not new. However, summarizing within one volume the results of nine years of exploitation of this controlled environmental facility, the Phytotron, should provide useful orientation for the novice turning his attention to this general area of experimentation. Furthermore, the autecological conception of what is important when applying an intelligent curiosity to the nature of plant growth will seem refreshing to many readers. *A. H. Brown, University of Minnesota.*

The U.C. System for Producing Healthy Container-Grown Plants. Edited by KENNETH F. BAKER. 332 pgs., illus. California Agricultural Experiment Station, Extension Service. Manual 23. Available from Agricultural Publications, 22 Giannini Hall, University of California, Berkeley 4, California (1957) $1.00

Nurserymen are growing plants in containers rather than in open fields on an increasing scale. When plants are grown in containers the root system encounters a definite volume of soil, and the soil environment can be carefully controlled in management by the nurseryman. The U. C. System involves the use of a growing medium consisting of fine sand and peat in varying ratios, depending upon the plant to be grown. In the 17 chapters in this manual, every phase of plant production for the nurseryman is considered. Particular emphasis is given to eliminating soil borne pathogens, the nutrition of plants and the possibilities of mechanising the process on a large scale. The material presented is primarily the work of a team of research workers at the University of California at Los Angeles and represents the results of many years of investigation and experience. The manual is clearly written and beautifully illustrated. Essentially a reference book, it will be helpful to anyone, scientist or grower, who wants to grow uniform plants under controlled conditions. A wealth of information is presented on biology and control of plant pathogens that inhabit the soil. *A. E. Dimond, Connecticut Agricultural Experiment Station, New Haven.*

★The Friendly Fungi. C. L. DUGGINGTON. 188 pgs., illus. The Macmillan Co., 60 Fifth Ave., New York, N. Y. (1957) $4.50

Like many British publications directed to the layman, this excellent little book contains a proportion of detail accurately described and well illustrated sufficient to make it profitable reading not only for laymen, but for professional mycologists and plant pathologists as well. The damage being done to crops in Britain by nematodes or eelworms is portrayed briefly in the opening chapters and an analysis of the difficulties of control is presented. The serious nature of the present situation is indicated by the fact that the potato root eelworm alone is responsible in Britain for the loss of a quarter of a million tons of potatoes annually. Because of the cost and impracticability of many of the possible control measures, the author suggests serious consideration of biological control, utilizing the predacious fungi that live in soil and decomposing organic matter and which destroy nematodes. There follows a lucid and, at times, exciting account of the best known predacious fungi, *Arthrobotryis oligospora, Dactylella* spp., etc. The various types of traps produced by eelworm-destroying fungi are described in detail with reference to the early researches of Zopf, Couch and Drechsler and a summary of the experiments of Comandon and de Fonbrune on the manner of operation of the traps. The obligate internal parasites of nematodes, such as the fungus *Harposporium anguillulae*, certain of the Lagenidiales and the curious basidiomycetous *Nematoctonus* are also described. The rest of the book is concerned chiefly with presenting the results of experimental efforts to use nematocidal fungi for the control of crop diseases caused by nematodes. Aside from the question of whether or not such biological control on a large scale is possible, the author has made a valuable contribution in presenting the "eelworm killers" for the delectation of the majority

of biologists who know little about them and even for the specialists. One might criticise occasional lapses into an overly-vivid style (p. 71, p. 77, etc.). However, these do not affect the main body of the text where the style is admirably clear and simple. Typographical errors are few and obvious and half-tones are well reproduced. *Harold J. Brodie, University of Alberta, Canada.*

MISCELLANEOUS

★Manual of Microbiological Methods. (Society of American Bacteriologists, Committee on Bacteriological Technic. M. J. Pelczar, Jr., Chairman) Edited by H. J. CONN. 315 pgs. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. (1957) $5.50

This book takes the place of the loose-leaf "Manual of Methods for Pure Culture Study of Bacteria" issued by the Committee during the period 1923 to 1956. The scope of the *Manual* has been extended, but is still intended for students and scientists who are studying and identifying pure cultures of microorganisms.

Various techniques are excellently described by sixteen specialists under the following chapter headings: Staining Methods; Preparation of Media; The Measurement of pH, Titratable Acidity, and Oxidation-Reduction Potentials; Maintenance and Preservation of Cultures; The Study of Obligately Anaerobic Bacteria; Routine Tests for the Identification of Bacteria; Physiological and Biochemical Technics; Serological Methods; The Detection of Bacterial Pathogenicity; Virological Methods; Inoculations with Bacteria Causing Plant Disease; Glossary of Terms Used on the Charts and in the Manual.

Most of the techniques described are basic procedures which are extensively used in microbiology. A few techniques, such as those used in microbiological assays, tissue culture, and microbial genetics, are incompletely covered. Considering the length of the book and its price, however, these omissions cannot be considered a deficiency. Every beginning student of microbiology should read this *Manual*. *J. R. Porter, State University of Iowa.*

International Review of Cytology, Vol. VI. Edited by G. H. BOURNE and J. F. DANIELLI. 566 pgs., illus. Academic Press, 111 Fifth Ave., New York 3, N. Y. (1957) $12.00

The most recent volume of this series is similar in approach and form to its predecessors. The area of Cytology is very broadly conceived, covering such diverse topics as the genetics of antigens in *Paramecium*, the penetration of nonelectrolytes into the red cell, and the role of carbohydrates in embryonic determination. The remaining papers deal with more strictly cytological problems: five are concerned in some fashion with the chemistry of cells or cell components (histochemistry of polysaccharides, histochemistry of bird and mammal embryos, enzymology of isolated nuclei, cytochemistry of mammalian tissues, and cytology of the thyroid). The remaining cover the chromosomes of rat ascites tumors, the structure of the Golgi apparatus, fertilization and activation of the egg, and the electron microscopy of viruses.

All the reviews are quite adequate for the areas covered; several are outstandingly good. Cytologists will continue to find these volumes useful for reference purposes, although other biologists may find some of the topics rather too specialized. *Joseph G. Gall, University of Minnesota.*

A Treatise on Limnology, Vol. I. Geography, Physics and Chemistry. G. EVELYN HUTCHINSON. 1015 pgs., 228 figures, 132 tables. John Wiley and Sons, 440 Fourth Ave., New York, N. Y. (1957) $19.50

Hutchinson has lived up to the fondest expectations of his many friends and admirers in *A Treatise on Limnology*. This is a masterful compilation of material, superbly organized in an excellent and readable presentation. To those who followed Hutchinson's Marginalia for years in the *American Scientist* it will come as no surprise that Hutchinson's wide grasp of the literature is clearly represented, that references to classical studies of lakes are not infrequent and that an occasional witty comment or fitting quotation appears in the midst of the most profound presentation. The publishers are to be congratulated on the excellent format and appearance of the volume. It is unfortunate that it is so expensive that smaller libraries, and some students will be unable to purchase it. For a field station or for one who plans a professional career in Limnology, however, this book is indispensable.

The author accomplishes his objectives as expressed in the Preface "The aim of this book is to give as complete an account as possible of the events characteristically occurring in lakes. The author, by training a biologist, is by inclination a naturalist who has tried to examine the whole sequence of geological, physical, chemical, and biological events that operate together in a lake basin and are dependent one on another". The book will indeed be found invaluable not only by professional limnologists, but also by biologists interested in the ecology or evolution of aquatic organisms, by geologists, chemists and all others who have a scientific interest in lakes and their characteristics.

In organization, each chapter starts with a lucid statement of the basic principles, which is generally followed by specific examples of characteristic differences drawn from lakes throughout the world, and concludes with a factual summary of the important conclusions in the chapter. These summaries live up to the hope expressed by the author that "The elementary student may find that these summaries, taken together, provide a simple account of what is actually known about lakes."

In the first chapter the author describes in some detail the origin of lake basins and summarizes 76 ways in which such basins may be formed. This chapter demonstrates Hutchinson's skill in synthesizing knowledge drawn from many sources to produce a coherent and readable account of the many ways in which lakes may be created. The next three chapters consider the morphometry and morphology of lakes, the properties of water, and the hydrological cycle and the water balance of lakes. This is followed by three chapters which consider the physics of lakes. One deals with hydromechanics, one with the optical properties and another with the thermal properties of lakes. The remaining ten chapters deal with the chemistry, first of rain water and then of lakes. In these chapters are discussed the oxygen, carbon dioxide, the minor metallic elements, the cycles of phosphorus, sulphur, silica, nitrogen, and iron and the organic matter in lake waters. Hutchinson has drawn together and tabulated the essential chemical data from a wide variety of sources, which alone would make the book invaluable to the student of limnology. The chemical chapters form the foundation upon which, no doubt, the biological cycles will be built in the second volume, which is anxiously awaited by all ecological limnologists.

Each chapter is written in ample detail for the professional limnologist. A ten page list of symbols used in the mathematical expressions will be invaluable not only to the reader of the book but also the development of future research and mathematical expression since Hutchinson has made an effort to avoid duplication of symbols. It has been necessary, of course, to change some symbols used in earlier work. In general, however, Hutchinson has followed common practice wherever possible.

Of inestimable value to the research worker is the bibliography of over a thousand references. Although expected from his previous publications, it is particularly gratifying to find the bibliography including so many references, not only in the usual German and French, but also in Italian, Spanish, Russian and Japanese. Another valuable characteristic of the bibliography is that an asterisk indicates works of exceptional limnological importance and those which contain extensive lists of references. In this way Hutchinson leads the student to the earlier work in the fields without unnecessary reference to "all the significant earlier investigations."

Speaking of the depth of lakes Hutchinson records the following anecdote (p. 170):

"In 1932 the writer was assured that a hermit who once lived on the shores of Lake Manasbal in Kashmir (Z_m = 12.7 m.), devoting his life to cording of rope with which to sound the lake. When the rope finally appeared long enough, he proceeded to his investigation, but feeling no

bottom when he had played out the entire length, he threw himself after the rope and was never seen again. The reader may draw any desired psychological implication from this or from similar stories."

The reviewer feels that he cannot recommend that students of limnology should cast themselves with such fervor into their work, but a student would be well advised to plumb to the best of his ability Hutchinson's *Treatise on Limnology* and it would be the rare student indeed who did not find new horizons and vistas upon becoming repeatedly immersed in this volume. *Bostwick H. Ketchum, Woods Hole Oceanographic Institute.*

Biochemical Cytology. JEAN BRACHET. 516 pgs. Academic Press, 111 Fifth Ave., New York. (1957) $8.80

This excellent text makes a definite contribution to the field of Biology. In this period of emphasis on integration of material and of concepts, such texts are needed. In the Preface the author states an aim of presenting a book that ". . . will prove useful to many advanced students and research workers." This reviewer feels that he has accomplished this, while at the same time providing the purely academic worker with material and ideas of great value.

The material emphasizes nucleocytoplasmic interactions using data which has been published as a result of work with unicellular organisms and with embryos. In certain respects the material is restricted to biochemical and cytological work with which the author has been directly concerned. This unbalance is understandable and excusable and does not seriously detract from the text.

Literature citations are numerous and current. The list of references, which includes many recent review articles, will be of great use to many workers and students. However, the frequent citations within the text do not lend to easy reading. A different format might have been more appropriate. In addition many of the text figures require either more text description or additional labeling. Although not entirely comprehensive in its discussions and integration, this text has great significant value generally. *John R. Harrison, Miami University.*

The Chemistry of Organic Medicinal Products. G. L. JENKINS, W. H. HARTUNG, K. E. HAMLIN, J. B. DATA. 569 pgs., illus. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. (4th edition, 1957) $10.75

The title denotes so inadequately the scope of the subject matter covered that this book is likely to escape the attention of many biologists. Except for brief typical syntheses and chemical properties, relatively little space is devoted to chemistry. Emphasis is placed on the biological effects of modern medicinal agents, and correlations between chemical structure and physiological activities are discussed. Owing to the modest size of the book relative to the breadth of the subject matter, many substances are dealt with only briefly; however, this defect usually is offset to some degree by the citation of pertinent literature references. With the exception of a chapter on antibiotics, the book adheres to a strict chemical organization. Although such organization facilitates use of the volume as a pharmaceutical chemistry textbook, it frequently precludes a grouping of compounds on the basis of a common use or type of medicinal activity. This arrangement tends to decrease the usefulness of the book for the biologist unless he knows either the chemical structure or name. This disadvantage could have been corrected by more thorough indexing in terms of activity. Nevertheless, its wealth of information makes this a useful reference book for biologists. *Paul E. Thompson, Parke, Davis & Company.*

Biophysical Chemistry, Vol. I. JOHN T. EDSALL and JEFFRIES WYMAN. 669 pgs., illus. Academic Press, 111 Fifth Ave., New York, N. Y. (1958) $14.00

This volume, which treats one of the more difficult aspects of biology, is superbly and clearly written. Each topic is carefully developed from first principles, and each term is carefully defined as it is introduced. The discussion centers around the biological significance of the properties of matter, and certain basic chemical and physical concepts are introduced and elaborated to provide the background of this topic. The next is an outgrowth of the course given at Harvard by the authors on the physical chemistry of biological systems.

The introductory chapter includes a discussion of the structure and history of the earth, its crust, and the oceans; this is followed by a discussion of the properties of water and their biological significance. The third chapter is an outstanding presentation of the present status of our knowledge of the components, bonds, cross-linkages, amino acid sequences, helical structure and stereochemistry of proteins. The basic principles of thermodynamics are presented in Chapter 4, followed by chapters on electrostatics, dielectric constants and conductivity.

The discussions of acid-base equilibria, of poly basic acids and of proteins as ampholytes (chapters 8 and 9), are superbly done. A short chapter on carbon dioxide precedes the final chapter (11) on certain aspects of molecular interaction, the binding of a variety of susbtances by proteins, and the relation of the phenomenon of binding to enzyme kinetics.

In the discussion of each topic the authors start from elementary principles and trace the development of the topic to the present frontiers of knowledge. The treatment of the subjects is based on the assumption that the reader is familiar with the fundamentals of calculus, organic and physical chemistry, and biology. The text does not attempt to provide a comprehensive discussion of the entire field of biophysical chemistry nor to present a compilation of data from experiment, but instead develops a limited number of topics outstandingly well. Most of these topics are related to proteins; the prime importance of the proteins in biological systems is now realized by all biologists. This book appears to be destined to take its place in the company of such classics as L. J. Henderson's "The Fitness of the Environment" and W. M. Clark's "Topics in Physical Chemistry". *Claude Villee, Harvard Medical School.*

The Origin of Life on the Earth. A. I. OPARIN: translated from the Russian by Ann Synge. 495 pgs. Academic Press, 111 Fifth Ave., New York 3, N. Y. (3rd edition, 1957) $6.80

It is welcome news to many biologists that Professor Oparin, Director of the A. N. Bach Institute of Biochemistry of the Academy of Sciences of the U. S. S. R. and holder of the M. V. Lomonosov Chair of Biochemistry in the Moscow State University, has extensively revised this work. The first edition was published in 1936, to be followed by a second edition in 1941, but little altered from the first. Most of us familiar with this work know it in the Morgulis translation based on the original 1936 edition, which was published by the Macmillan Company in 1938 and reprinted by Dover Publications in 1953. The manuscript of the present edition was closed late in 1956, and gives evidence of being actively in revision until that time.

During the two decades between the first edition and the present version much took place in the field of biochemistry. Professor Oparin accordingly has considerably amplified his background evidence and, in various ways, altered his method of approach. Although the text is thoroughly revised, the basic ideas and propositions remain much what they were in 1941. This does not in any way lessen the usefulness of the present edition or the need for biologists to have it available in their libraries.

For those not familiar with Oparin's basic concepts it should be stated that he concludes that the primal seas contained a wide variety of "organic" compounds which has been abiotically synthesized. By the process of coacervation these organic compounds became organized into a multitude of different types of systems. These, Oparin is careful to point out, did not exhibit the phenomenon of life but, rather, set the stage for the development of even more complex coacervate systems.

At this point Oparin further develops the theory of the dynamics of "open" systems operative within enclosing (and often selective) membranes. This is necessary for, to him, life exists only within an "open" and not a "closed" system. The final stage, extending over a vast stretch of geologic time, was the development of

coordinated enzyme systems within the coacervates, at first randomized but later "directed" by the selective forces existing within the abiotic but chemically complex environment. When various of these enzyme systems had been stabilized the most primitive types of what might be called life could then come into being.

Oparin holds that the first living things were both heterotrophic and anaerobic, deriving their sustenance and energy from the organic substances in which their environment then abounded. He also holds that the chemoautotrophic and photoautotrophic organisms were derived later from heterotrophs. The well-known fact that many so-called autotrophs normally shift to a heterotrophic condition under certain conditions, or can be induced to do so when artificially cultured, is held to be a strong indication that the autotrophic condition merely has been superposed on the more primitive heterotrophic condition without its having been lost.

Because of the wide ranging nature of his theoretical considerations Professor Oparin has been forced to select his evidences so as to hold the text within reasonable bounds. There are places where cosmogonists, biochemists, cytologists and evolutionists doubtless individually will wish he had included other material or will take issue with his conclusions, but they scarcely dare ignore the basic thesis of this provocative work. As would be expected, considerable use is made of recent Russian literature, much of which is not easily available to us. However, there seems to be little hesitation in rejecting Russian work which appears to be unsound, or of criticizing it in the light of the work of non-Russians, of which much use is made. Mrs. Synge has given us a felicitous and lucid translation. *W. H. Camp, University of Connecticut.*

A History of Luminescence from the Earliest Times until 1900. E. NEWTON HARVEY. 692 pgs., illus. American Philosophical Society, Memoirs Volume 44, Philadelphia, Pa. (1957) $6.00

On an early page the author of this scholarly and heavy tome gives the keynote of the whole work, in the form of a quotation from Pliny the Younger: "It is a noble employment to rescue from oblivion those who deserve to be remembered". Professor Harvey, in the midst of a distinguished career of researches especially on bioluminescence, has given "ten years of special study," according to the note on the dust-jacket, to read and assess all the significant literature bearing on the subject of "cold light"; or in the words of Wiedemann, "all those phenomena of light which are not solely conditioned by the rise in temperature." The result is a lengthy catalogue, divided into chapters at first chronologically and later by subjects (electroluminescence; phosphorescence; shining fish, flesh and wood; animal luminescence; etc.), replete with quotations and short summaries of work accomplished by individual investigators. The casual reader of the book may be disappointed by the seemingly endless catalogue of those who discovered or noted inconsequential facts, and by the relatively slight attempt, on the part of the author, at summarization and interpretation. The more serious reader, however, will find a mine of information not only on luminescence in all its aspects, but also on the history of alchemy, chemistry, optics, electricity and Natural History. The bibliography includes an estimated 1700 titles, and there is a short subject index and a somewhat longer author index. Use of the volume as a reference work would have been facilitated if the indices had been more complete; urine, for example, appears but once in the index although there are various references to it in the text in connection with early methods of obtaining phosphorus and the search for the philosopher's stone. *Rogers McVaugh, University of Michigan.*

Introduction to Enzymology. ALLAN H. MEHLER. 400 pgs. Academic Press, 111 Fifth Ave., New York, N. Y. (1957) $10.80

The dust jacket to the present book states the following: "The principal objective of the book has been to describe the properties of individual enzymes and to develop general concepts from considerations of specific information." There are, of course, two objectives implied here and it would have been pleasant to report that both have been successfully attained. However, this book informs primarily by descriptive detail. There is relatively little illumination by brilliant generalization. The organization is one which encourages fragmentation rather than synthesis. The material is systematized on metabolic rather than enzymatic grounds, with separate chapters on reactions involving sugars, amino acids, polynucleotides, et cetera. Examples of virtually all the known enzymatically catalyzed reactions are discussed at one place or another in the 400 pages of text. It ends up at best as a concise and competent description of the facts of enzymology.

In trying to evaluate an effort of this kind, it is relevant to raise the question of what class of readers a book of this sort is likely to serve. It seems to the reviewer that relatively few would profit from any extensive effort at mastering its contents. It is far too detailed for those who wish to acquire a general knowledge of the principles and mechanisms which have emerged from present day enzymology. On the other hand, it is not detailed enough for those who wish to employ experimentally the facts described.

A book synthesizing the data of enzymology into a coherent description emphasizing general principles remains to be written. It seems regrettable that so much care and competence was lavished on a work which could have served a broader purpose, but doesn't. *Sol Spiegelman, University of Illinois.*

The Lipids: Their Chemistry and Biochemistry, Volume III. HARRY J. DEUEL, JR. 1065 pgs. Interscience Publishers, 250 Fifth Ave., New York 1, N. Y. (1957) $25.00

With its two sister volumes this most recent addition completes what is undoubtedly the most authoritative and comprehensive reference available on the biologically active lipids. The set comprises ample evidence that publication *in extenso* by a single competent author is still within the realm of the possible even in the rapidly growing areas of science. By careful organization and frequent cross-reference, Dr. Deuel has succeeded in treating a formidable mass of information with almost unique clarity and continuity.

Conflicting theories are in general presented objectively, although the author has not reneged on his responsibility to evaluate controversial points. In most instances both data and concepts have been carefully documented with references to the original literature.

Volume I dealt with lipid chemistry, volume II with the digestion, absorption, transport and storage of lipids, and volume III treats the intermediate metabolism and nutritional significance of the lipids. In spite of an unfortunate price, *The Lipids* is certain to become a standard reference in libraries of chemistry and biochemistry. *Kendall W. King, Virginia Polytechnic Institute.*

★The Strategy of the Genes. C. H. WADDINGTON. 262 pgs. The Macmillan Company, 60 Fifth Ave., New York 11, N. Y. (1958) $4.00

Professor Waddington wisely gives his book a sub-title—"A Discussion of Some Aspects of Theoretical Biology." What he has given us is a compact presentation of the way he is now thinking about what he calls in the preface "two of the major classical problems of biology—firstly, the nature of biological organization and the developmental processes which bring it into being, and secondly, the theory of evolution." Waddington for some time has been using his firsthand knowledge of developmental biology and his command of mathematical formulations, in grappling with some of the problems of evolution which confront a geneticist. He makes clear where he has gotten, but, this book is no simple series of essays from which anyone interested can effortlessly gain understanding. A list of the chapter heads will make this clear. They are: 1) Form, End and Time; 2) The Cybernetics of Development; 3) Selection of, for and by; 4) The Organization of the Gene Pool; 5) The Survival of the Adaptable; and an Epilogue. Kacser's essay follows, entitled "Some Physico-chemical Aspects of Biological Organization." But with some effort, how much depending on the reader's background and habits of thought, there are real rewards. Here is some stimulating thinking on development and on evolution. *Harriet Creighton, Wellesley College.*

Survey of Biological Progress, Vol. III. Edited by BENTLEY GLASS. 332 pgs. Academic Press, 111 Fifth Ave., New York 3, N. Y. (1957) $7.50

The first half of the twentieth century has seen a marked increase in the trend toward specialization. At the same time the need for some understanding of activities and ideas from related fields has been apparent to the research person as well as the classroom teacher. This third in the series of surveys of various fields of biology makes an important contribution to the biologist who is concerned with the need to keep abreast of what is happening. Six articles comprise this volume. In the first, Jane Oppenheimer traces the growth of a few arbitrarily chosen aspects of embryological investigation, pointing out the fact that the science of the present is built on that of the past, using new techniques and interpretations. In the second review, David D. Keck discusses trends in systematic botany. No longer are systematists content to rely only on morphological similarities or differences or geographical distribution for revisions or studies, but are more and more utilizing such disciplines as genetics, anatomy, cytology, paleobotany, embryology, ecology, and physiology. M. J. D. White discusses some of the general problems of chromosomal evolution and speciation in animals, showing how such factors as chromosome structure and rearrangements, increases or decreases in number, or fusions of sex chromosomes may affect polymorphism and speciation. V. G. Dethier, reviewing work on chemoreception and the behavior of insects, show that four patterns of behavior—host-finding and discrimination by parasitoid insects, trail-following, orientation to odors by flying insects, and courtship—depend for their successful consummation upon a variety of stimuli of which the chemical ones are of critical importance. Rachmiel Levine, reporting results of investigations with insulin, adrenaline, and the four active principles of the thyroid hormones, states that the evidence indicates that the outer cell surface and the surfaces of nuclear or mitochondrial membranes serve to regulate entrance and exit of such materials. This strengthens the present-day view of biochemists that form and function are interdependent. George G. Laties gives a detailed review of the present knowledge of the regulation of the respiration rate in intact organs, mitochondrial systems, the relation of the Pasteur Effect to rate-regulating mechanisms, physiological aspects of rate regulation as seen in wound respiration, growth and water uptake, and the relation of salt absorption to respiration, concluding with an excellent discussion on the climacteric in apples and avocados in relation to respiratory changes associated with ripening.

The present volume follows the same high standard set by Dr. Avery, who edited the first two volumes in the series. It is hoped that succeeding volumes will help to bring biologists up to date on further topics of concern and interest. The remarkably complete bibliographies accompanying each article enhance the usefulness of the volume. *Ruth S. Breen, Florida State University.*

The Species Problem. Edited by ERNST MAYR. 395 pgs., 35 illus. Publication No. 50. American Association for the Advancement of Science, 1515 Massachusetts Ave., Washington 5, D. C. (1957) $8.75 (to members of AAAS $7.50)

The contributors to this volume were: John Langdon Brooks, Hampton L. Carson, Verne Grant, John Imbrie, Ernst Mayr, John A. Moore, C. Ladd Prosser, and T. M. Sonneborn. This imposing roster brings together a varied background on the problems of species, from both the taxonomic and the experimental viewpoint. This book is the outcome of a symposium presented at the Atlanta meeting of the American Association for the Advancement of Science, December 28-29, 1955. Like many symposia, this one was integrated chiefly by its title, and also by the fact that every participant has had difficulties of some sort with "species."

Books produced by the collaboration of several authors are sometimes described as collections of essays. This would not be appropriate in the present case, because most of the contributions are actually reports of the conditions found in the author's special field. As such they are factual rather than analytical. Any chance of unity in the symposium or the book was lost when most of the participants interpreted the phrase The Species Problem to mean The Problems I Encounter in Trying to Deal with Species.

These remarks are not intended as criticism of the papers. Anyone interested in the problems encountered in the specific taxonomy of a wide range of organisms, flowering plants, *Daphnia*, fishes, fossil invertebrates, and protozoans, will find much of interest here. Dr. Mayr has skillfully introduced the subject and summarized the reports in the light of his well-known belief that species must be defined on the basis of populations which do or can interbreed. Since the great majority of taxonomists study groups in which this criterion cannot be determined, they may possibly note that several of the contributors see insurmountable *practical* difficulties in the use of such a definition, even though they accept it in theory. *R. E. Blackwelder, Box 500, Victor, N. Y.*

Trace Analysis. (Papers presented at a Symposium held at the New York Academy of Medicine, Nov. 1955.) Edited by JOHN H. YOE and HENRY J. KOCH, JR. 672 pgs., illus. John Wiley & Sons, 440 Fourth Ave., New York, N. Y. (1958) $12.00

The importance of trace constituents for many biological processes is well known, and new examples of their potency are continually being added. Determination of these biologically active trace materials is often one of the most serious problems in their study. The papers presented in this book should aid in this problem by acquainting biologists and biochemists with the methods now available for the analysis of trace constituents. Some of these methods are capable of measuring elements present in concentrations as low as 1 part in 10^{12}. The methods of analysis discussed include chromatography, ion exchange, extraction, chemical microscopy, spot tests, colorimetry, fluorometry, flame spectroscopy, potentiometry, coulometry, polarography, amperometry, emission spectral analysis, gamma ray-spectroscopy, mass spectrometry, x-ray spectroscopy, x-ray micrography, neutron activation analysis, and microbiological techniques. The book deals principally with the determination of inorganic constituents, although analyses for organic materials are included in a few of the papers.

The discussion of each subject includes a general description of the method, of the instrumentation required, and of its potentialities and limitations. The general quality of the papers, both in content and in presentation, is high. It should be possible from most of the papers for a biologist to tell whether or not a particular technique would be applicable to his problem; there is sufficient detail so that the chemist will find the book a useful review of modern analytical procedures in these fields. References to more extensive treatment of the various subjects are given. Separate chapters deal in greater detail with the problems of instrumentation in general, and of sensitivity and contamination. The book is attractively put together, and there are few typographical errors. *Mary Belle Allen, University of California, Berkeley.*

***Of Men and Marshes.** PAUL L. ERRINGTON. 150 pgs., illus. The Macmillan Co., 60 Fifth Ave., New York, N. Y. (1957) $4.50

In ten short chapters and an epilogue, the author of this book sits in an armchair and thinks "out loud". His thoughts are about his lifetime of experiences in and around marshes. The first chapter constitutes a statement of what marshes are, how they came into existence, and of his dissatisfaction at man's effort to obliterate them by draining, especially for economic reasons. The next four chapters, about one-third of the book, are devoted to a vivid description of life in marshes through the seasonal activities. In these chapters the author provides us with his own rich and intimate experiences covering the many years he has studied marshes. Reading these pages is much like sitting before a fascinating teacher who has a rare thorough grasp of his subject matter not derived from books, but directly from nature. Throughout the book the author combines a naturalist's ability to observe with an outlook that is impersonal. His descriptions are very well written and he points out, even though briefly, some of the geological and physical principles involved.

As might be expected from a vertebrate ecologist there are few references to invertebrates. This is acceptable since the contribution by invertebrates to the main topic of the book is not obvious. The muskrat is the dominant animal in the book. There is a great amount of detail about how a muskrat makes its livelihood throughout the year. Particularly good is his description of the struggle of the muskrat to survive when his habitat freezes over in a matter of hours.

The chapter titled "Of marshes and marshes" is a geographic run-down on marshes outside of the Dakotas. The author classifies marshes as muskrat marshes and waterfowl marshes. He gives the impression that the marshes of South Dakota are marshes at their best. As one goes north something happens to the "South Dakota image of marshes." Directional extensions of South Dakota marshes are places where one or more types of marsh animals may become abundant due to local climatic advantages, lack of predators or more abundant food.

Chapter 8 is titled, "Of marshes and safety and comfort". The author is concerned with the necessary nuisances of marshes and offers advice to those who frequent marshes at various times of the year, and discusses the diseases that may be contracted under certain circumstances.

In a chapter titled, "Of marshes and peace of mind", the author grumbles at discourteous hunters, "sky reachers", litterers, etc. Inserted in this chapter is a statement, "I find no peace of mind when with men who make sweeping assertions that conservation agencies know nothing and never will and that this scientific stuff about wildlife management is baloney." Also this chapter he provides us with what appears to be at least in part a purpose for the book: ". . . I think that the outdoor values that have meant so much to my life are among those worth preserving in modern civilization and those that every well-intentioned person should have a right to share if he wishes." In another later chapter the author encourages wider participation by the public in the quieter use of marshes, the walking along shore or the slipping of a canoe around rush clumps with due care not to disturb wild creatures.

In the Epilogue the author takes up his muskrat theme again and attempts to draw parallels between the biology of muskrats and that of man. "Being only lower animals, the muskrat may not be expected to teach man much about population behavior that is not elementary, but it is surprising—and frightening—how unaware influential people may be of the simpler biological backgrounds of sociology and economics during periods of crisis and political upheavals." The author states explicitly that he has attempted to present a realistic portrayal of small scenes in the drama of life that may be conducive to more realistic human appraisals of some of the fundamentals underlying social relationships.

This book is a timely reflection on the current status of marshes and their value as the site of the biology of the many forms of wildlife that use them. It calls attention to the fact that we are draining marshes excessively and are sacrificing wildlife or natural values, which cannot be recreated except in the wake of another glacier, for a certain amount of temporary economic value. *Gabriel W. Comita, North Dakota State College.*

Rhythmic and Synthetic Processes in Growth. Edited by DOROTHEA RUDNICK. 217 pgs., illus. Princeton University Press, Princeton, N. J. (1957) $7.50

This volume contains the papers presented at the fifteenth Symposium of the Society for the Study of Development and Growth held at Providence, R. I., in July, 1956. The wide range of thought provoking and original articles contributed in the preceding, as well as in the present, publications of this series can be appreciated by the content of the cumulative index appended to the last volume.

The first three papers in this volume grouped together under the subheading "Tissue culture methods" are related by their probing into the mechanisms of multiplication and differentiation of isolated and organized units of life. T.T. Puck describes techniques for clonal cell culture with high plating efficiency, the changes of these cultures in respect to morphological patterns and the effects of x-ray irradiation on their growth parameters. The author points out the applicability of his tissue culture method to the clarification of the role of genetic and non-genetic factors in cell differentiation, for a more systematic study of the genetic alterations and mutagenic mechanisms in mammalian cells, the genic basis of hereditary diseases, aging and neoplasia. In the following paper, "The Multiplication of RNA Containing Animal Viruses," R. Dulbecco raises the question of the significance of RNA in mechanisms of self replicating biological units and points to the basic similarities and differences in the reproductive cycles of RNA and DNA containing viruses. In "Growth and Differentiation of Plant Tissue Cultures," the last paper of this section, Richard M. Klein describes the effects of nutritional and physical factors on in vitro development of plant cells. Included in the discussion are considerations of growth curves, oxygen uptake, CO_2 production, of the response to growth factors and of the induction of growth factor synthesis as well as comments on differentiation of the certain plant tissues.

In the following group of papers entitled "Cyclic Activity," David M. Prescott discusses "Relations Between Cell Growth and Cell Division." This analysis, based on growth measurements on single amoebae and on synchronously developing cell populations represents a valuable approach to the understanding of nucleocytoplasmic interactions. Colin S. Pittendrigh and Victor G. Bruce give a fascinating account of

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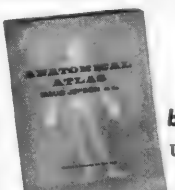

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possible, temperature independent, mechanisms as a basis for "An Oscillator Model for Biological Clocks" and E. Bünning deals with the role of physical and metabolic factors, and of the protoplasmic structure in the control of "Endogenous Diurnal Cycles of Activity in Plants".

The last section on Biochemical Evolution is opened by H. Gaffron's article, "A Photosynthesis and the Origin of Life." The author combines breadth and depth of thought in developing a challenging picture of the first appearance of organic substances on this planet and of their significance in the archetypical synthesis of the porphyrin ring system. In his contribution "On the Origin of Self-Replicating Systems," H. F. Blum is primarily concerned with the original energy utilization and energy transfer in the synthesis of proteins and nucleic acids and the appearance of optical isomerism. B. L. Strehler marshals much evidence in suggesting a model for the transformation of photochemical into biochemical energy which occurs during the initial phase of photosynthesis. ("Some Energy Transductions Problems in Photosynthesis".) The volume concludes with a glimpse on "Photosynthesis and Life on Other Planets: A Summary" by Harlow Shapley.

Although the three groups of papers may seem, on the first approach, to be devoid of a deeper relation they all deal essentially with changes in the basic patterns of life as functions of the biologically important arrows of time; philogenetic change, ontogenetic change, and functional change. It may be symbolic that the first and last plate in the book convey somewhat similar optical impressions though the one depicts evolving cells, the other evolving stars. This implicit relationship adds to the entertainment and edification in reading the individually interesting and competent contributions to this volume. *Heinz Herrmann, University of Colorado Medical School.*

★Modern Chemistry for the Engineer and Scientist. Edited by G. ROSS ROBERTSON. 442 pgs., illus. McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. (1957) $9.50

Nineteen nationally known chemists, academic and industrial, contributed to an extension course, bearing the title of this volume, during the academic year 1954-55 under the auspices of the Colleges of Engineering and the Departments of Chemistry of the University of California. Each summarized the accomplishments and the newer methods of his respective field. However, the chapters of the resulting book are by no means confined to practical technology. Interesting developments in food and petroleum chemistry are presented. The application of chemistry to life is treated and the editor writes, "this phase in one sense may be regarded as the highest development of the science." Nominally these lectures were aimed at the graduate in physical science—to bring him up to date in certain fields of chemistry. This need not deter other scientists—the occasional scholarly exposition over one's head can be both stimulating and highly worthwhile.

Selected Scientific Papers from the Instituto Superiore di Sanita. Vol. 1. 233 pgs. Interscience Publishers, 250 Fifth Ave., New York 1, N. Y. (1956) $8.10

Modern Methods of Microscopy. A series of Papers Reprinted from "Research". Edited by A. E. J. VICKERS. 114 pgs. Interscience Publishers, 250 Fifth Ave., New York 1, N. Y. (1956) $3.50

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